Nash

TECHNICAL SERVICE MANUAL

ALL WEATHER EYE

AIR CONDITIONING

System

FOREWORD

This manual is prepared to give the Nash Servicemen a Fundamental knowledge of the principles of air conditioning as applied in the passenger car field. Also, outlined is the information required to properly service and maintain such a system.

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DIVISION OF NASH-KELVINATOR CORPORATION

DETROIT 32, MICHIGAN

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FUNDAMENTALS OF AIR CONDITIONING

The air conditioning system as adapted to automotive use, is very similar in function and operates on the same basic principles as the modern home refrigerator. However, due to the adaptation and the layout in a passenger car, various components will vary somewhat from that of a refrigerator.

The introduction of a certain amount of fresh air, when air conditioning a passenger car, is desirable for personal comfort, primarily to prevent the accumulation of undesirable smoke or odors in the car. Also, the air is cooled at somewhat higher temperatures than in a refrigerator, in air conditioning. A temperature differential of fifteen to twenty degrees lower than the outside air is desired. It is not necessary to "pull the air down" to a low temperature that might be uncomfortable to the passengers.

Air conditioning may be defined as the simultaneous control of all of those factors affecting both the physical and chemical condition of the atmosphere within any structure. These factors include temperature, humidity, motion, distribution, dust, bacteria, odors, and toxic gases; most of which affect, in greater or lesser degree, human health and comfort.

The *prime factors* which are to be considered in air conditioning are, therefore, temperature, humidity, distribution, and cleanliness of air within an enclosure.

The foregoing factors and the function of air conditioning in relation to each of them will be discussed briefly.

TEMPERATURE CONTROL

The control of temperature involves the regulation of the temperature to a comfortable degree. Human beings possess a capacity to sense the "Heat" and "Cold" in objects or in surroundings only insofar as their temperature is different. When we say that water is "cold", we mean its temperature is lower than that of our body. When we say water is "hot", we mean its temperature is higher than that of our body. Heat is a positive condition, a form of energy, which cannot be destroyed. It is the Kinetic energy (energy of motion) that is present in molecules and atoms of all bodies and substances on this earth, on the sun, and on all its planets. Heat, though not visible in itself, can be measured quantitatively. The basic units of heat measurements are: Degrees, Fahrenheit which denotes the temperature of the heat in a substance and B.T.U. (British Thermal Unit) which denotes the quantity of heat present in the substance.

Cold is the absence of heat or the lack of heat. Then heat being energy cannot be destroyed and cold is the lack of heat, consequently, a thing or place is cold to the extent that heat has been removed from it. Refrigeration is a process developed to remove heat from objects or places. Heat always moves from a warm object or place to a colder object or place.

The control of temperature in air conditioning is accomplished by transferring heat from a place where it is not wanted to a place where it makes no difference. The mechanical method and cycle will be discussed later.

In the case of passenger car air conditioning, we attempt to lower the temperature inside the car to a comfortable range namely 15 to 20 degrees below the outside temperature. The outside ambient temperature may be high and uncomfortable in respect to comfort. Ambient temperature is the encompassing or outside surrounding temperature.

Solar radiation contacts portions of the car and its passengers creating "hot spots" inside the car. This tends to heat the inside of the car equivalent to or above that of outside temperature. This certainly does not lend to the comfort of the passengers, especially so on long trips or in slow congested traffic conditions.

HUMIDITY CONTROL

The ambient air may be humid or dry. The air within an enclosure such as the car, will be correspondingly affected as a certain amount of fresh air is used in the air conditioning cycle. All atmospheric air, unless specially treated, contains a certain amount of moisture in the form of water vapor. The amount of water vapor present varies from day to day depending upon the weather conditions. Air is said to be dry when it contains no water vapor whatsoever.

In lowering the temperature of the inside of the car, the relative humidity is usually lowered. A high relative humidity of the air is one factor that is predominant in personal discomfort. Humidity is the amount of moisture in the air in the form of gaseous vapor. Relative humidity is the ratio of the weight of water vapor present in a given sample of air at a given temperature to the weight of water vapor which would be present in the same sample, if the air were saturated at the same temperature and pressure. It should be noted that air at any fixed temperature can only hold a definite known quantity of water. At higher temperatures, air is capable of holding more moisture than at lower temperatures. Hence, if the temperature of saturated air is lowered, the excess

water vapor will condense.

This is a basic principle in the control of humidity in air conditioning.

In air conditioning or refrigerating the air, the air is dehumidified by lowering the moisture content of the air. This is possible by lowering the temperature of the air below the dew point and consequently condensing some of the moisture out of the air. The water vapor condenses on the cold evaporator core and the liquid is drained off.

To reduce the relative humidity completely in a system such as this is not desirable. Relative humidity does have a significant effect on comfort within a fairly wide temperature range.

The normal comfort zone for people has been found to exist within a temperature range of 67° to 91° and the relative humidity range of 30% to 70%. Combinations of temperatures and relative humidities outside of this range produce various types of discomfort.

CONTROL OF DISTRIBUTION AND CLEANLINESS

The control of distribution, motion, and cleanliness can be covered as one item. Twenty-five to thirty per cent fresh air is introduced into this particular system. At the point of introduction, the air is being cleaned of dust and pollen in passing through the filter provided for this purpose. Blowers in the system will re-circulate the air in the car through the cooling unit, consequently, the air temperature is being constantly lowered. The air is being freshened by re-circulation and also by the addition of the fresh air being introduced into the car. The entrance of fresh air added to the volume already present will serve to pressurize the car interior. Air will then leak outward carrying with it smoke, odors, and carbon dioxide. Pressurizing the car prevents entrance of hot dusty air. The air being circulated is returned and carried over the evaporator and cooled in a continuous cycle, thus re-filtering the air. It must be remembered to effectively air condition the car, all windows should be closed and remain closed during the time the air conditioner is being used. (In addition to the blowers re-circulating air, the fresh air being introduced by forced convection will serve also to re-circulate the air.)

To accomplish the foregoing controls in air conditioning, a mechanical means must be employed. Mechanical refrigeration or mechanical air conditioning is the system used.

MEANS OF PRODUCING REFRIGERATION

A substance or body is said to be refrigerated when heat is removed from the substance or body faster than it can gain heat. Whenever this condition exists, the temperature of the substance is lowered or reduced.

Refrigeration may be produced by several methods. The vapor compression system is employed in the Nash All Weather Eye Unit. In the compression system a suitable liquid is evaporated in the cooling unit at a low pressure and then compressed to a high pressure in the mechanical compressor and then condensed to a liquid again in a condenser completing the refrigeration cycle. This method utilizes the "Latent Heat" or hidden heat of vaporization to produce the desired refrigerating effect.

Latent heat of evaporation is defined as the quantity of heat necessary to evaporate or convert one pound of liquid to vapor without change of temperature.

Thus, the latent heat of evaporation for water is 970 B.T.U., since it takes 970 B.T.U. to evaporate one pound of water at 212° F. and atmospheric pressure to steam at same temperature and pressure.

The latent heats of evaporation of different substances differ considerably from each other. For example, latent heat of evaporation for "Freon-12" is 71.95 B.T.U. at atmospheric pressure as compared to that of water which is 970 B.T.U.

The Refrigerant

A fluid when used as a cooling medium may be termed a "Refrigerant." The term refrigerant as used in this discussion is defined as a chemical used in compression systems to produce the desired cooling effect or refrigeration by using the latent heat of vaporization of that particular chemical.

An important factor in selecting a liquid refrigerant is a suitable boiling point. For example, Freon-12 boils at −21.7° Fahrenheit at atmospheric pressure of 14.7 pounds per square inch or zero pounds per square inch gauge pressure at sea level. Freon-12 is a chemical used in most applications of refrigeration or air conditioning.

Some of the characteristics of Freon-12, which is used as the refrigerant in the Nash All Weather Eye System, are as follows:

- Non-toxic, unless combined with flame.
- Non-inflammable and non-explosive.
- Non-corrosive except in the presence of moisture.
- Boiling point at atmospheric pressure lower than cooling unit temperature.
- Suction pressures usually above atmospheric pressure.
- Low compression ratio.
- Stable.
- Lubricant Solubility.

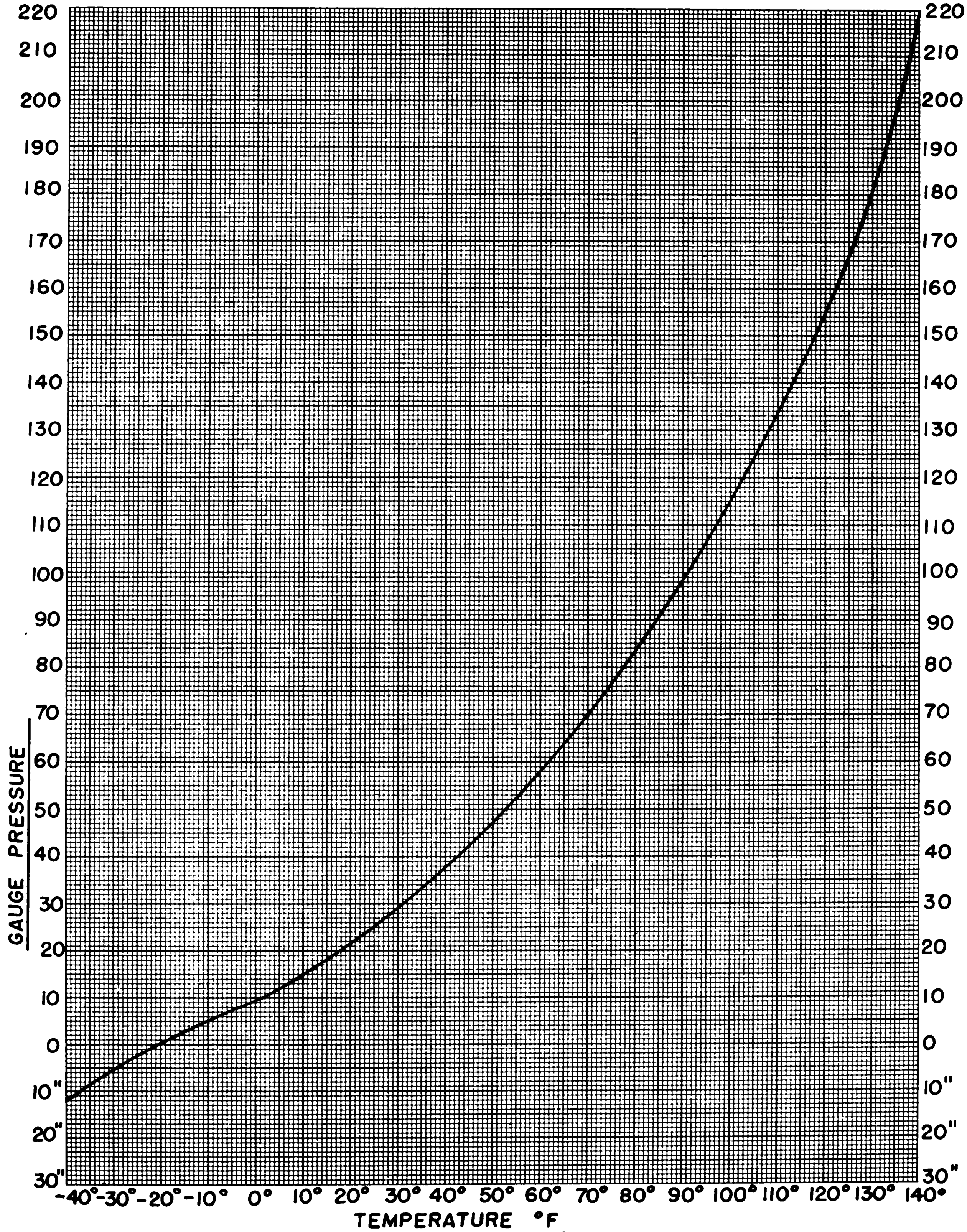


FIGURE 1
FREON-12 TEMPERATURE PRESSURE RELATION CURVE

TEMPERATURE PRESSURE RELATION

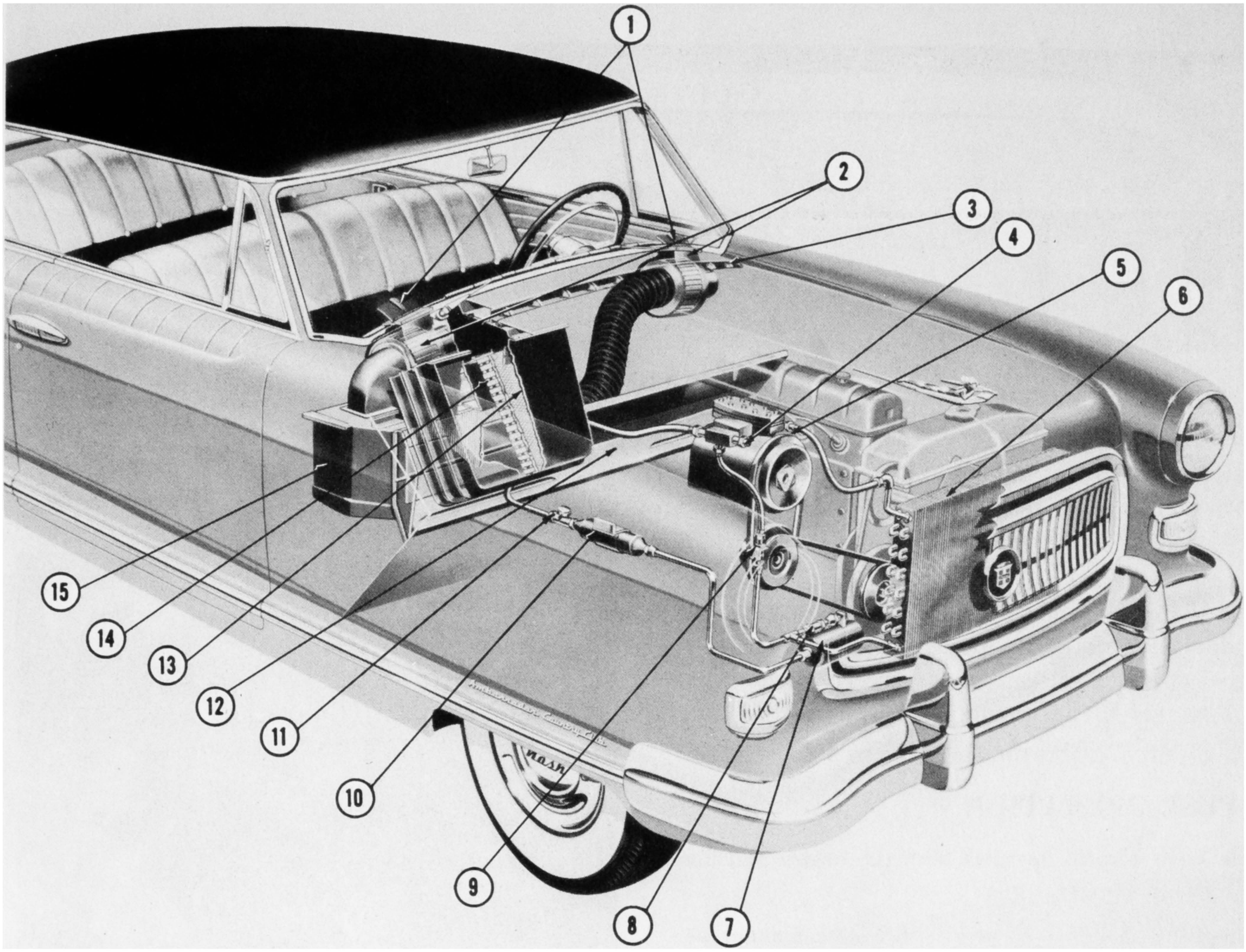
Any change in the temperature surrounding a vessel that confines a liquid refrigerant will change the pressure in that vessel in direct relation to the physical properties of the liquid. Increasing the temperature around the vessel will raise the pressure in the vessel and conversely lowering the temperature will lower the pressure. Since the boiling point of any liquid is determined by the pressure under which the liquid is confined any change in pressure on the liquid will change its boiling point. Temperature pressure relation of Freon-12 is shown in Figure 1. This graph will assist in diagnosing pressure difficulties.

REFRIGERATION SYSTEM

In any refrigeration system we employ a refrigerant which alternately is evaporated from its liquid condition to form a vapor, and condensed so that the vapor returns to the liquid form. The refrigerant is a substance that evaporates rapidly at low temperatures. As the liquid is evaporated, it absorbs heat from everything around it and lowers the temperature. Then the absorbed heat is in the vapor. As the vapor is condensed back to a liquid it loses the previously absorbed heat. By causing evaporation to take place where temperature is to be lowered, then causing condensation to take place where the discharged heat won't be objectionable, the refrigeration cycle is accomplished.

The physical changes relative to the function of various units that take place in the normal refrigeration cycle will be discussed briefly for each unit in the system.

DESCRIPTION AND OPERATION



1. **Discharge Air Outlets**
2. **Blowers**
3. **Fresh Air Intake**
4. **Compressor**
5. **Magnetic Clutch**
6. **Condenser**
7. **Receiver**
8. **Check Valve**
9. **Solenoid By-Pass Valve**
10. **Filter**
11. **Sight Glass**
12. **Heater Duct**
13. **Fresh Air Filter**
14. **Heating Unit (Heater Core)**
15. **Cooling Unit (Evaporator)**

FIGURE 2
ALL WEATHER EYE SYSTEM

The Nash All Weather Eye System is designed to accomplish cooling, heating, and defrosting with the same unit. Basically, the function of the system as an air conditioner is to filter, cool, dehumidify, and circulate the air within the car. As a heater, the system will function in the same manner as the Weather Eye Heater and Defroster.

The Weather Eye has always been an integral part of the Nash Body. The design of the composite system is to include a common forced air convection system for heating, cooling, and defrosting air.

Various advantages are accomplished with the All Weather Eye design. Quick cool down is effected at average driving speeds.

Twenty-five to thirty per cent fresh air is admitted through the cowl air intake to the car while cooling, in addition to the air being re-circulated and freshened by the blowers incorporated in the system.

The refrigeration capacity is sufficient to maintain a fifteen to twenty degree outside to inside temperature differential at thirty miles per hour. The controls are in keeping with the relative simplicity of previous systems and enable the cooling or heating to be carried on at a comfortable level.

The drive pulley incorporated on the compressor has a magnetic clutch. When the air conditioner is not

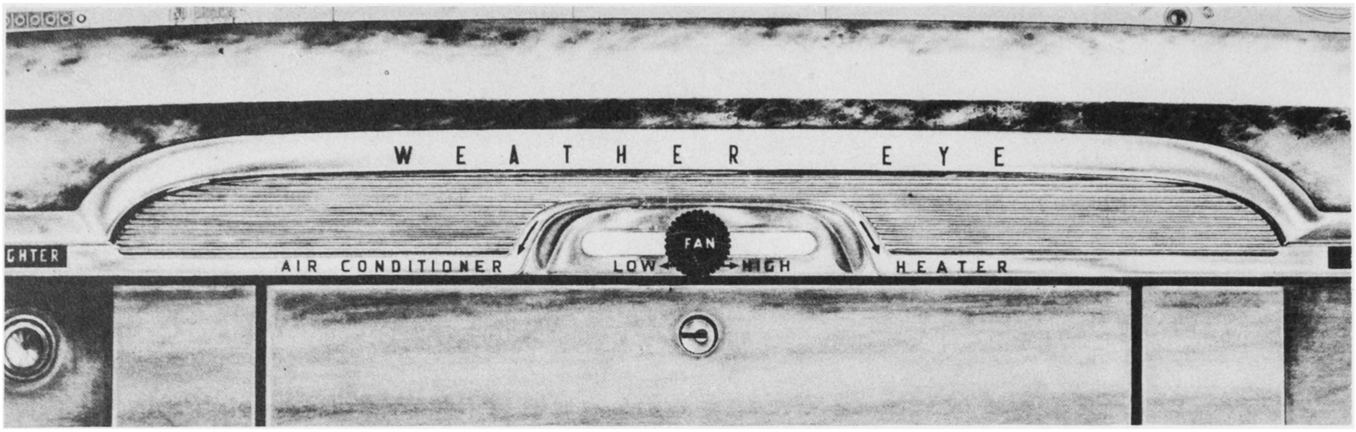


FIGURE 3
AIR CONDITIONING AND HEATER CONTROL KNOB

in use, the drive pulley free wheels and the compressor is not running. The system when in use does not affect engine operation either in smoothness or cooling.

The unit is compact and unique. The cooling unit is in the dash compartment. The cooled air is introduced by two discharge air grilles located at each end of the instrument panel. The compressor, receiver, sight glass, and filter are in the engine compartment. The condenser is located ahead of the radiator.

HEATER OPERATION

Single knob control operates both the heater and air conditioning systems.

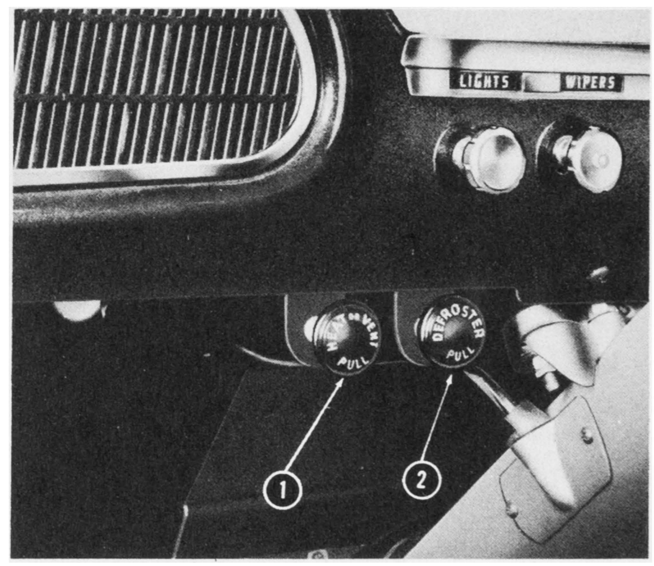
The heating system operates in the same manner as the standard Weather Eye. The water valve control knob is moved from left to right to increase and thermostatically maintain the amount of heat required.

The water valve control knob has two positions to operate the two speed high capacity blowers, which are utilized for circulation of heated air in slow traffic conditions, and for frosted windshields. Turn clockwise to the first position for low speed blower operation; the second for high speed operation.

The heating system utilizes 100% fresh air at all times. The cowl ventilator damper should be open during the heating cycle. The control knob (Fig. 4) is located on the dash panel marked "Heat or Vent"; "Pull" opens the cowl ventilator.

The defroster damper is located in the heater and return air duct. The knob (Fig. 4) "Pull-Defroster" places the damper in the closed position shown in Figure 6. The open position is illustrated by the dotted line.

This directs the heated air into the evaporator housing; into the blower housings; out of the air discharge grilles and through the defroster air discharge doors which should be open during the heating and defrosting cycle (Fig. 5).



1. Cowl Ventilator Damper Control Knob
2. Defroster Damper Control Knob

FIGURE 4
HEATER AND DEFROSTER
DAMPER CONTROL KNOBS

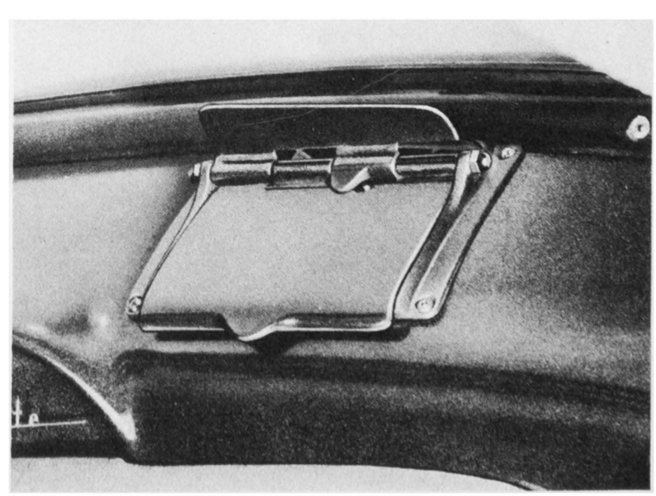


FIGURE 5
DEFROSTER DOOR POSITION

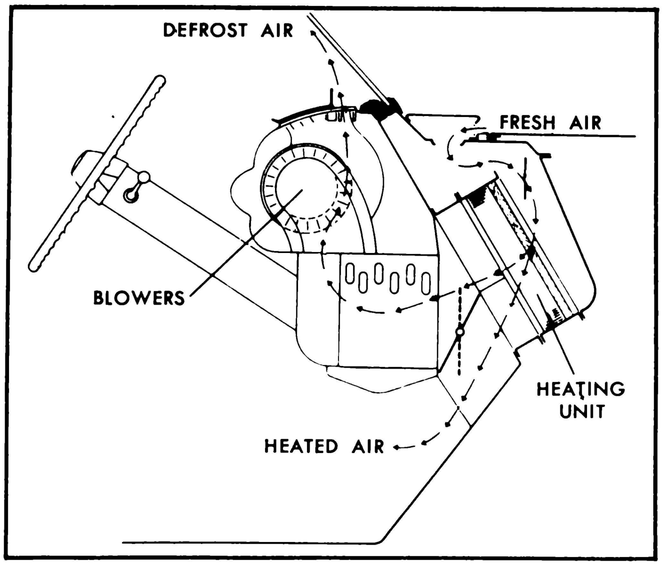


FIGURE 6
DAMPER POSITIONS AND AIR CIRCULATION FOR HEATER AND DEFROSTER AIR "AMBASSADOR" AND "STATESMAN" SERIES

During the time that heat is normally required, this knob is pushed in and the damper would be in the open position as shown by the dotted line in Figure 6.

AIR CONDITIONING OPERATION

The cooling system is placed in operation by having the water valve control knob in the far left or "OFF" position, and by rotating the knob counter-clockwise to the "Low" and "High" position; "Low" being the first position.

Normally, to gain a quick cool-down effect, the air conditioner would be turned on the "High" blower speed position. When the air has been pulled down to a comfortable range, the "Low" position can be used to maintain the temperature at this range.

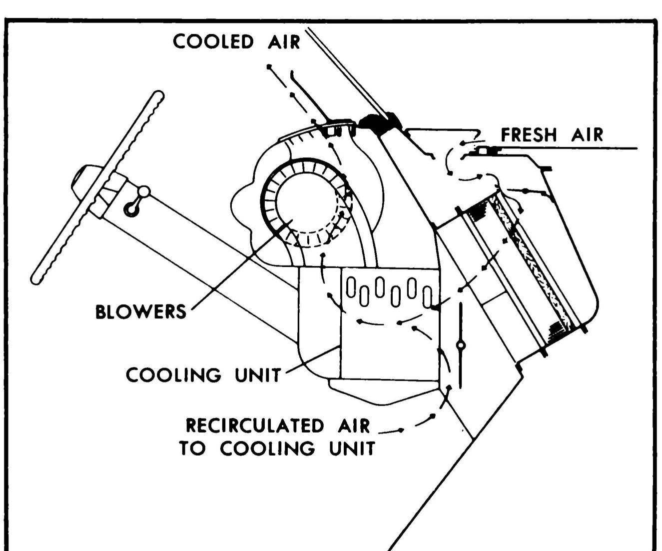


FIGURE 7
COOLING SYSTEM AIR CIRCULATION "AMBASSADOR" AND "STATESMAN" SERIES

In the "High" or "Low" switch position the cooling operation is in effect as the blowers are then on; the magnetic clutch is energized and engages the compressor pulley driving the compressor. The solenoid by-pass valve position is normally open, when the system is not in use, but when the air conditioning switch is energized, the solenoid is energized closing the solenoid valve and the refrigerating cycle is underway. The solenoid valve function is also controlled by the temperature control thermostat in the cycling operation of the system. This will be discussed later as each component unit is covered.

The large air discharge grille doors located in the outlets on each side of the dash should be in the open position; the defroster air discharge grille doors are closed during the use of the air conditioning system (Fig. 8). The large doors have two "open" positions, high or completely open, and low. The high position will direct the cool air upward and natural circulation takes place, the air moving along the top of the car from front to rear and return under and around the seats. The low position will direct the cool air toward the lap area of the front seat passengers. This position may be used when only these passengers are in the car or when driving directly into the hot sun.

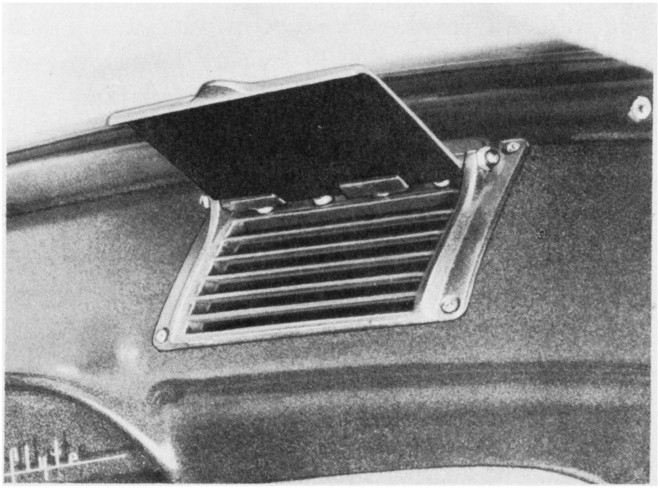


FIGURE 8
FULL "OPEN" POSITION AIR DISCHARGE GRILLE DOOR

The cowl air intake ventilator damper is in the closed position as the control knob marked "Heat or Vent" is pushed in. The damper in the heater and return air duct is in the straight up and down position. This is controlled by the knob marked "Pull-Defroster". During air conditioning, the knob is pushed in.

Fresh air seeps past a fixed opening in the cowl damper. Only one rubber seal is used in lower edge of damper. The air passes over a baffle to remove moisture and is then directed through the filter which removes dust and pollen. Air from within the car is

drawn in from below through the return air opening in the heater duct and is intermixed with the fresh air from the cowl vent. The fresh air would constitute a twenty-five to thirty per cent factor by volume. The air is then drawn through the cooling unit by the two speed, high capacity blowers and directed out of the two outlets located on the instrument panel. All discharge grille doors should be closed when neither cooling or heating systems are used. (Although during heating it may be permissible to open the large doors.)

To effectively air condition the interior of the car, the windows and ventilators should be closed during the time the air conditioner is in operation.

OWNER MAINTENANCE AND OPERATION

An important point in owner maintenance is to keep the condenser core clean of bugs, leaves, dirt, or anything that may catch in the condenser core.

Under conditions where the system may be operated with the car standing, for more efficient cooling, run the engine well above idle speed, preferably at 750 to 800 R.P.M.

AIR CONDITIONING SYSTEM CYCLE

The Nash All Weather Eye System consists of a compressor, condenser, solenoid by-pass valve, receiver, sight glass, filter, expansion valve, evaporator unit, temperature control thermostat, and two blowers. Figure 2 illustrates the identity and location of some of the various components.

The functions of the various units in the system will be pointed out in the following description of the air conditioning cycle. At times reference will be made to "high side" and "low side" so named because the refrigerant dealt with is at high or low pressure at the time it is referred to as such. The "high side" consists of the compressor, condenser, receiver, sight glass, filter, and expansion valve. The "low side" will consist of the expansion valve, evaporator, temperature control thermostat, and compressor, also the connecting lines between the units. The high pressure lines may be readily recognized as they are smaller in diameter than the low pressure lines.

NOTE: The compressor and expansion valve are mentioned in both sides, actually they are the dividing points between high and low pressures.

Continuous Cycle of Air Conditioning

The following chart outlines the continuous refrigeration cycle.

Compressor

The compressor is designed to be capable of having sufficient capacity at variable speeds. A two cylinder reciprocating type compressor is used. It is mounted on the side of the engine and driven by a "V" type belt from a two sheave idler shaft or in the case of a car equipped with power steering by a two sheave pulley on the power steering pump.

The idler shaft or power steering pump is in turn driven by a belt from the crankshaft pulley.

The idler shaft or power steering pump whichever the case may be, is adjustable by a slotted link to the engine. The compressor belt tension is adjustable by a slotted bracket to the engine. Both belts require a tight adjustment. Reduce the "flex" to a minimum.

The capacity of a compressor is generally stated in terms of "tons of refrigeration", or B.T.U. per hour. A ton of refrigeration is the cooling effect resulting from the melting of 2,000 lbs. of ice in 24 hours or one ton is equivalent to a cooling rate of 12,000 BTU/Hr.

The All Weather Eye System has a capacity of 1½ tons at 30 M.P.H., thus it is capable of removing heat from the interior of the car (including the fresh air admitted) at the rate of 18,000 BTU/Hr.

The primary purpose of the compressor is to increase the relatively low pressure of the gas returning from the evaporator to a high pressure. By compression, the vapor temperature is so increased that it is higher than that of the condensing medium.

Discharge and Suction Service Valves

The discharge and suction service valves are three position valves and are mounted on each side of the compressor. The discharge service valve is located on the left hand side of the compressor. The suction service valve is located on the right hand side of the compressor (Fig. 10).

The suction side of the compressor is further identified by the word "Suction" cast in the cylinder head.

The purpose of a three position valve is to allow a gauge connection to be made and used while the system is in operation. This can be used for service checks, bleeding, evacuating, and charging. Also, the compressor may be removed from its bracket to enable engine work to be performed on the car by closing the service valves and removing them intact with the lines attached, from the compressor.

When the stem is turned in, the valve is "Closed." When the stem is turned out, the valve is "Open." When the stem is turned to the half-way position, the valve is commonly known as being "Cracked" (Fig. 11).

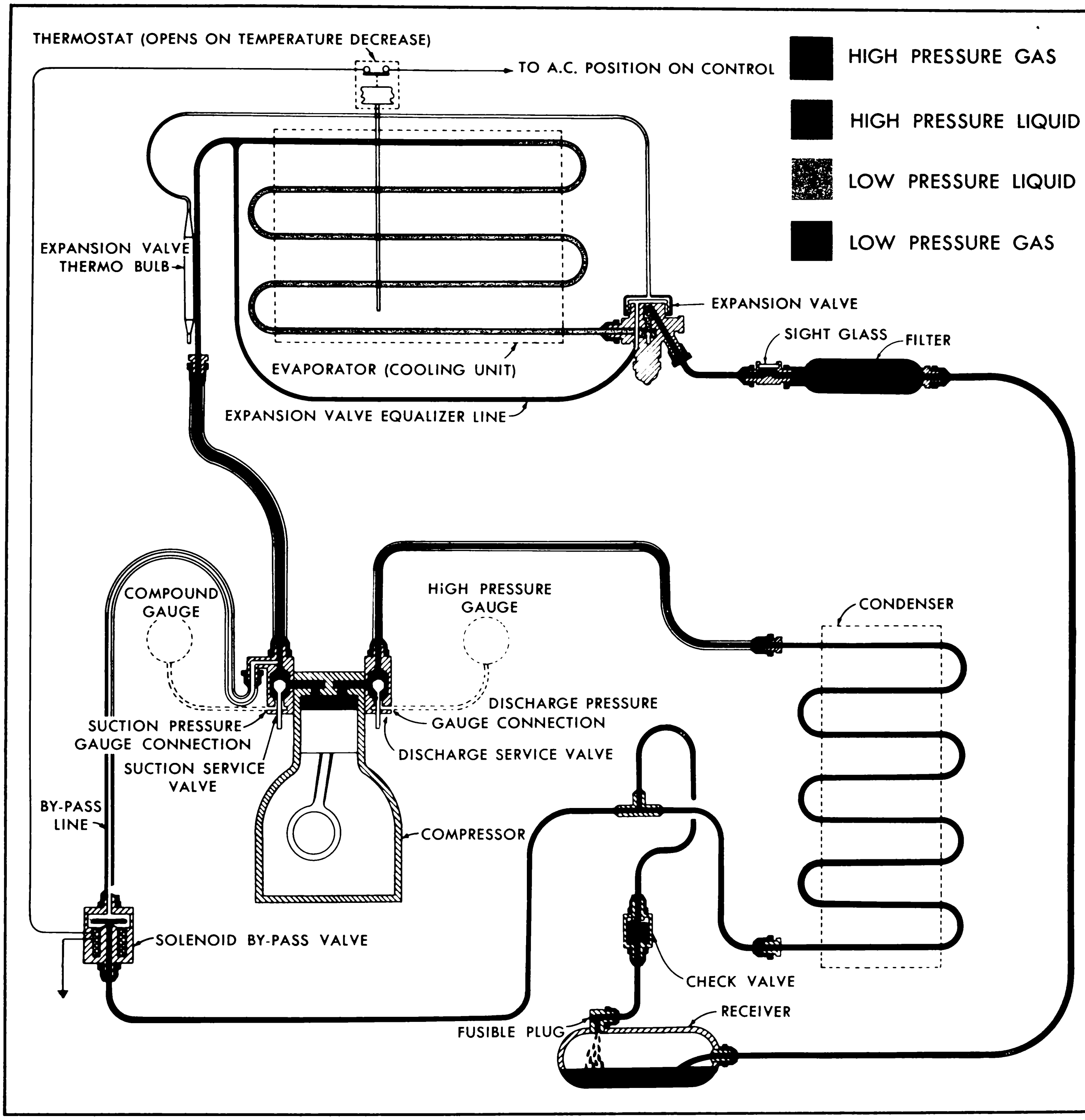
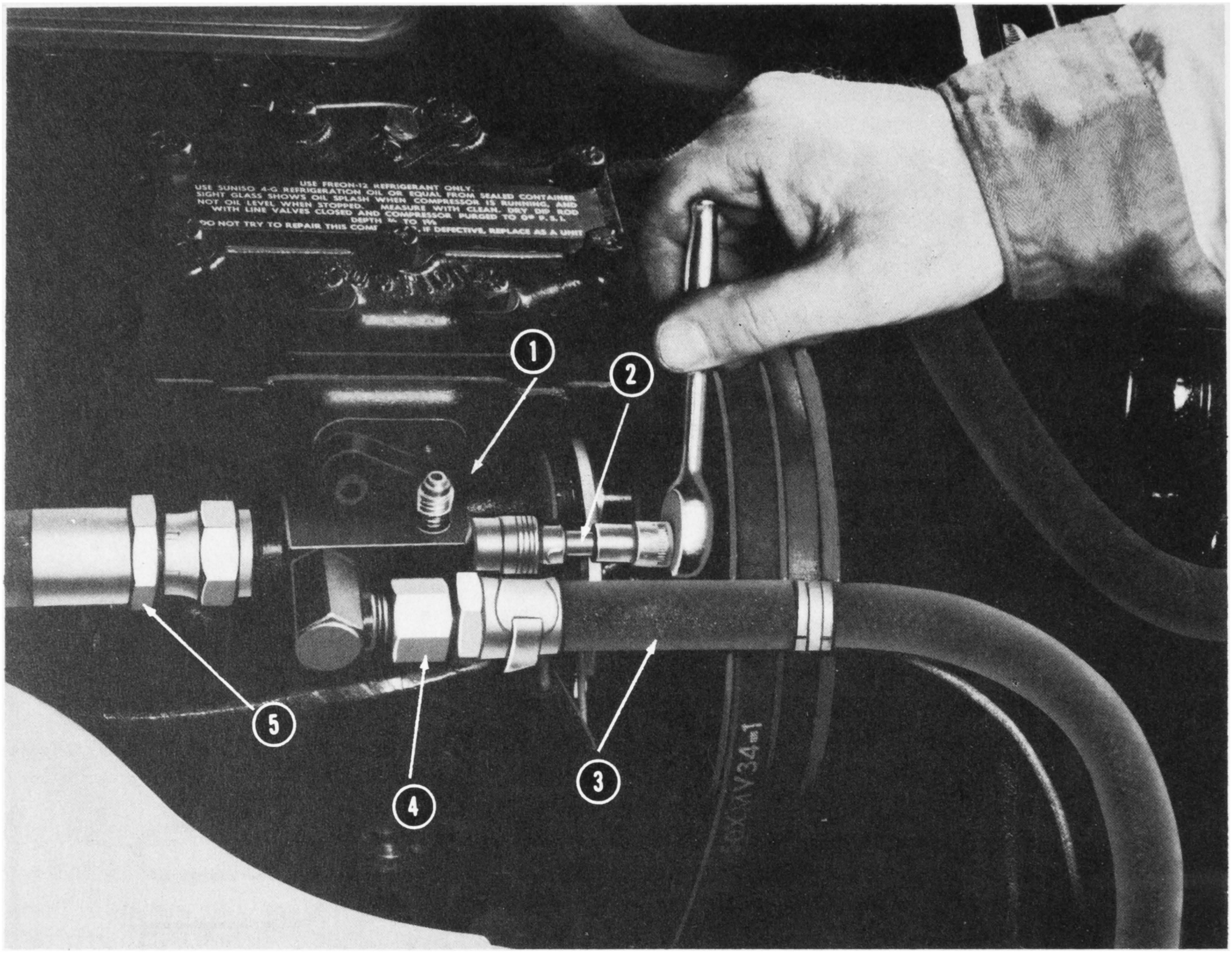


FIGURE 9
CONTINUOUS REFRIGERATION CYCLE

The Freon-12 refrigerant gas enters the compressor through the suction service valve at the same pressure as the gas in the evaporator. It goes through a close mesh strainer upward through inlets in the valve plate into the low pressure side of the cylinder head which is divided into two compartments by ribs cast into the cylinder head. Both suction and discharge valves are the inertia type with both suction and discharge ports in the one valve plate. The valves flex to open and the lift is limited. On the downward stroke of the piston, the suction valve is opened due to differential pressure filling the cylinder with low pressure Freon-12 vapor. When the piston starts on the up stroke, pressure immediately closes the suction valve. The piston forces the vapor into the discharge side of the cylinder head through the discharge valve, from where it goes out of the compressor through the discharge service valve (Fig. 12).

The discharge pressure is governed by the suction pressure, the temperature and the amount of air passing over the condenser. A decrease in the flow of air or an increase in the suction pressure will increase the discharge pressure. An increase in the air flow over the condenser or a decrease in suction pressure, will lower the discharge pressure. Normally the discharge side of the compressor is referred to as the "high side".



1. **Suction Service Valve Port Connection**
2. **Valve Stem**
3. **By-pass Line**
4. **By-pass Line Connection**
5. **Suction Line — Evaporator to Compressor**

FIGURE 10
SUCTION SERVICE VALVE AND CONNECTIONS

Condenser

The high pressure, high temperature vapor produced by the compressor is directed through a high pressure line to the condenser. The condenser is located ahead of the radiator, mounted on the radiator air baffles.

The heat of compression and the latent heat of vaporization absorbed by the refrigerant in the cooling coil is rejected to the air flowing over the finned condenser tubes, liquefying the refrigerant.

The temperature of the air used to cool the condenser is lower than the saturated temperature for the compressor discharge pressure. Freon-12 gives up its latent heat of evaporation during this process to the coolant air and in this way the heat removed from the car is given up to the atmosphere. The condenser temperature is dependent upon two factors, the temperature and amount of the air flow across the condenser core.

Receiver

The receiver located on the right hand side of the front crossmember is a reservoir which stores the liquid refrigerant which is still under high pressure. Under normal operating conditions, the receiver should be about one-half filled. As the liquid condenses, it drops into the receiver; the outlet tube delivers the liquid refrigerant to the expansion valve. The pick-up tube or quill should normally be below the liquid level; the upper half of the receiver is normally in a high pressure vapor state. To determine the level, place your hand on the receiver; the part containing the liquid will be colder than the vapor half (Fig. 13).

The receiver is equipped with a fusible plug, set to discharge at 367°F. In the event of a fire or development of excess refrigerant pressure, the fusible plug will melt releasing the entire refrigerant charge harmlessly to the air outside the car.

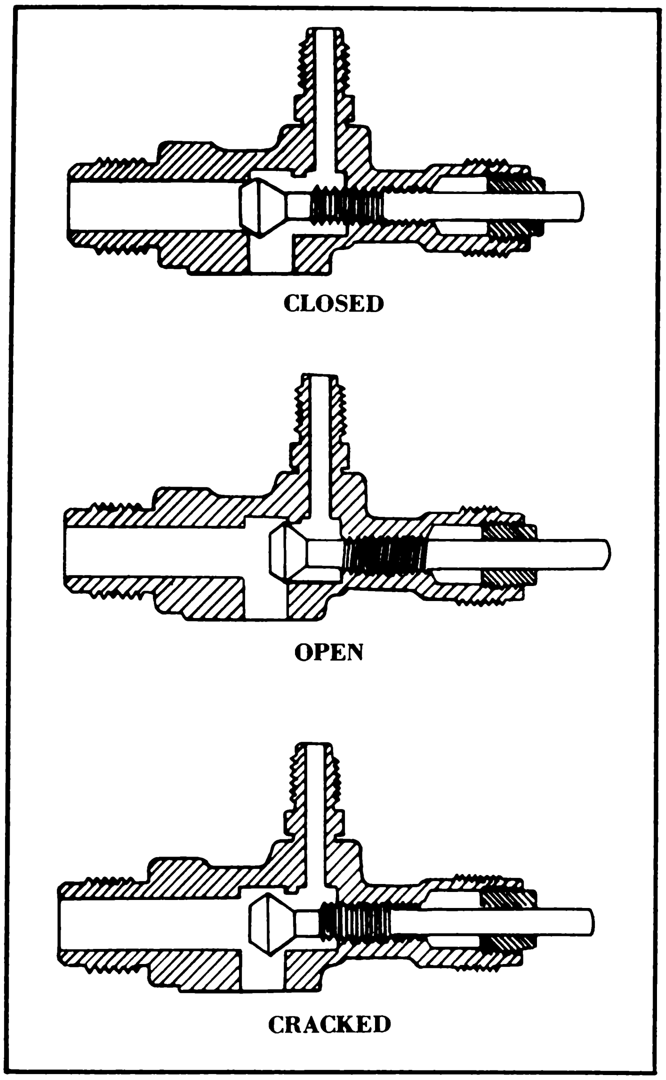
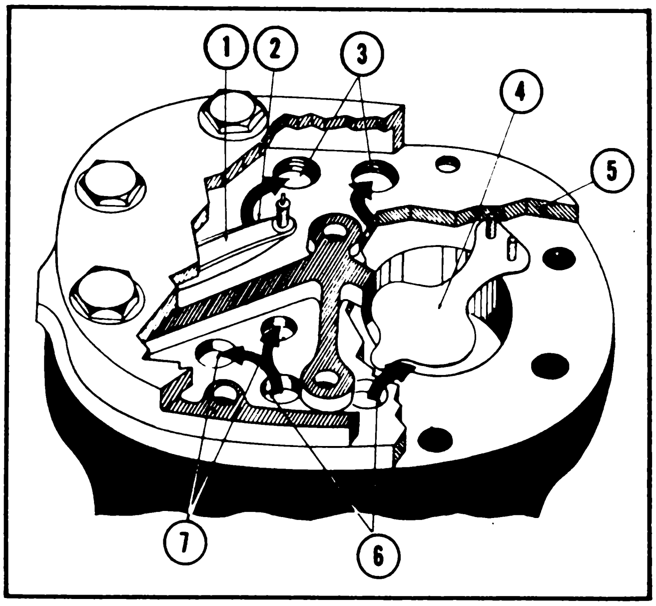


FIGURE 11
SERVICE VALVE POSITIONS

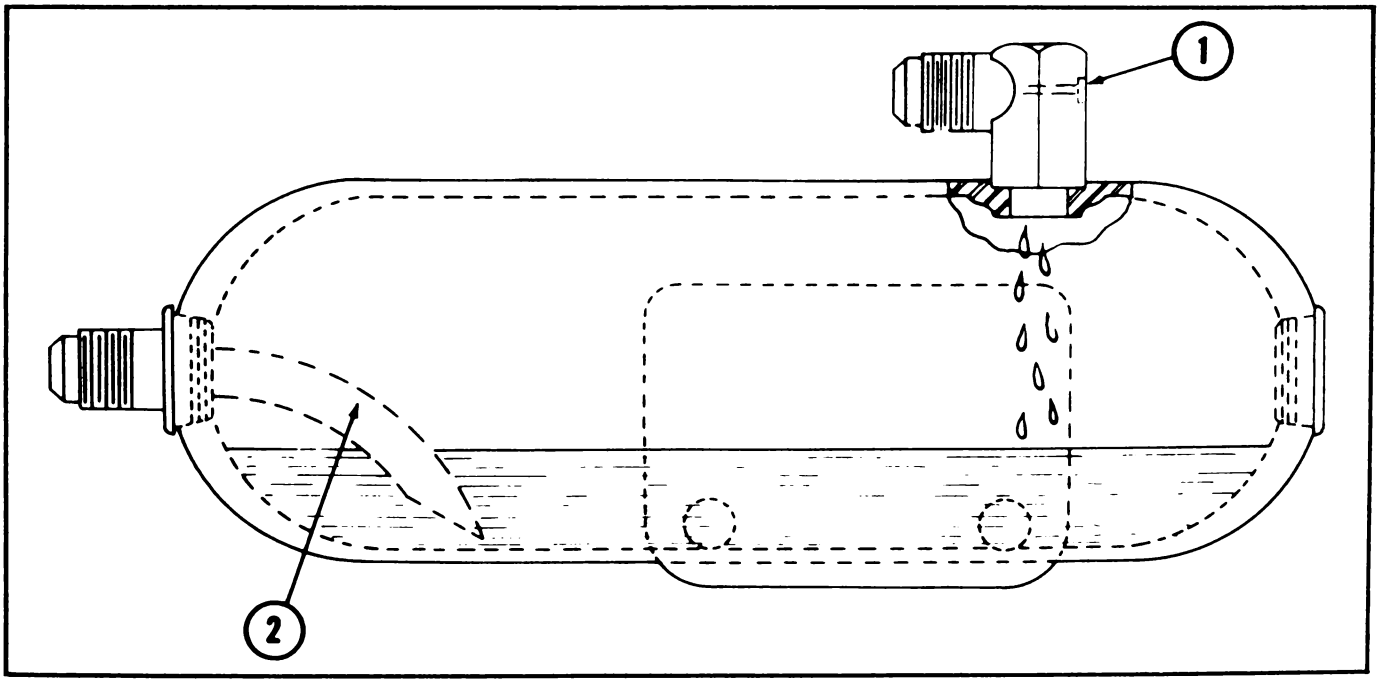


1. Discharge Valve
2. Discharge Opening in Valve Plate
3. Discharge Outlets
4. Suction Valve
5. Valve Plate
6. Suction Inlets
7. Suction Openings in Valve Plate

FIGURE 12
COMPRESSOR VALVES AND PATH OF REFRIGERANT VAPORS

Filter

The liquid refrigerant flows under high pressure through the filter. This unit has a fine mesh wire screen that removes any dirt that may be present in the system (Fig. 14).



1. Fusible Plug 2. Pick-up Tube

FIGURE 13
RECEIVER

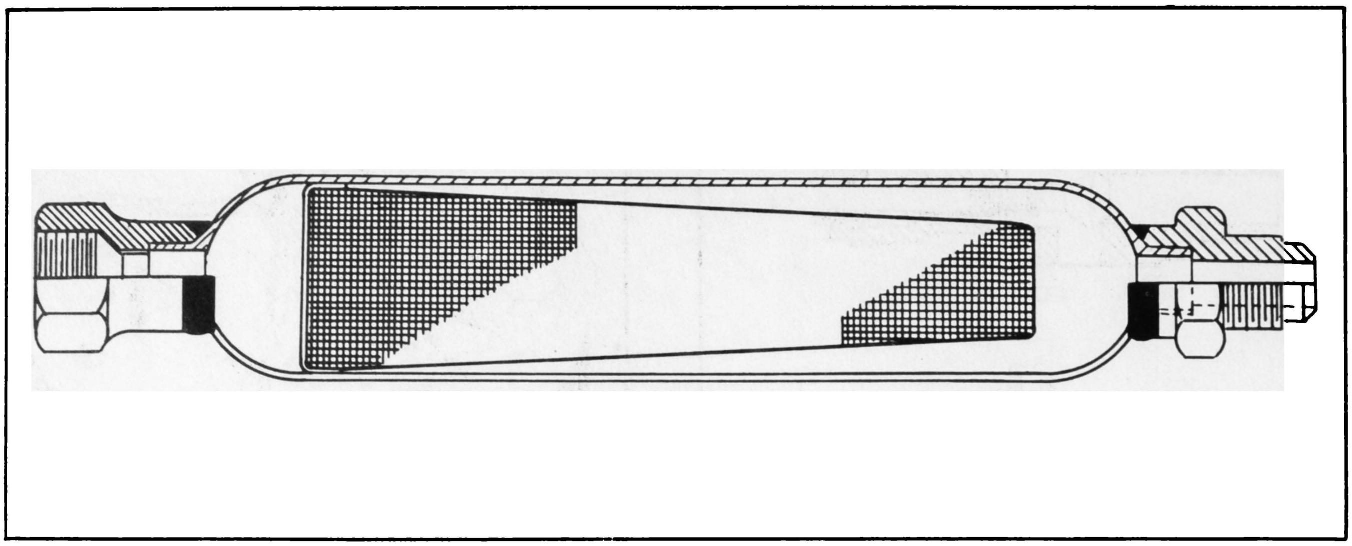


FIGURE 14
FILTER

Sight Glass

The high pressure liquid flows from the filter through the sight glass.

The sight glass and the filter are mounted on the right hand wheelhouse inner panel (Fig. 15).

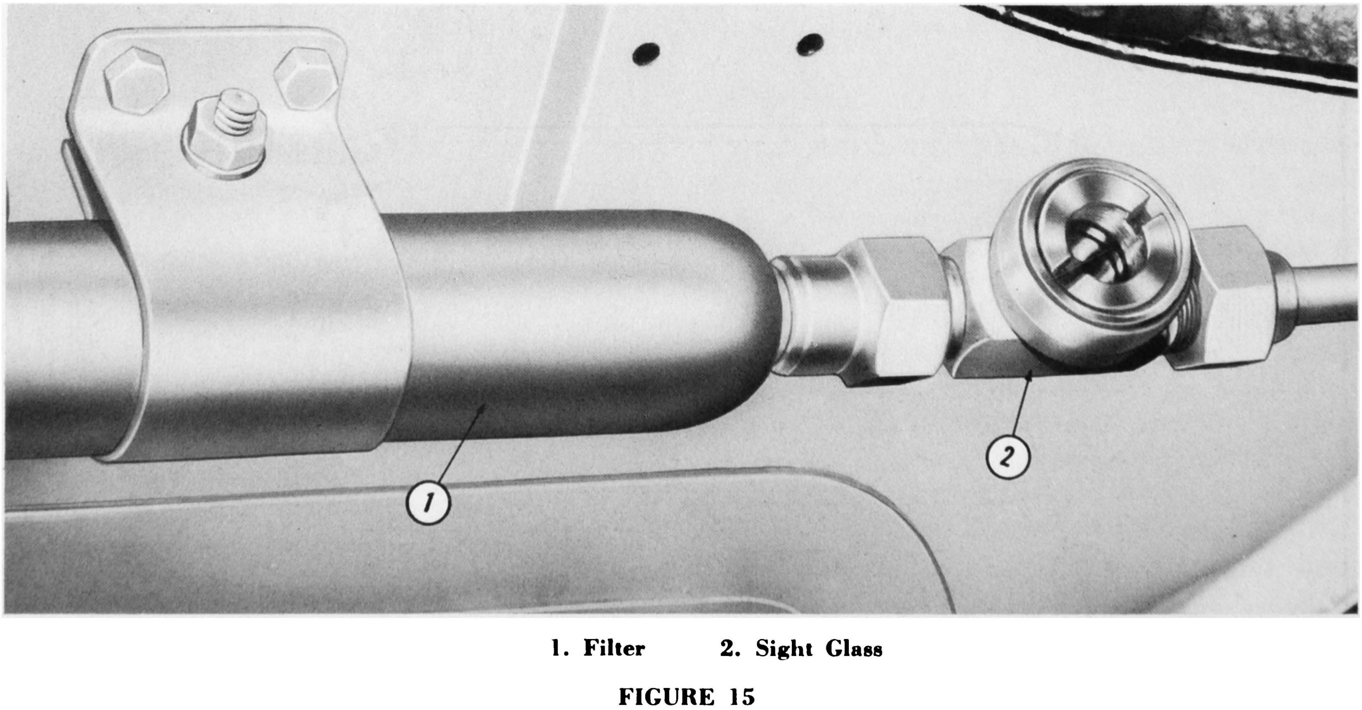
The sight glass provides a quick and sure way of checking the refrigerant charge in the system. Presence of bubbles or foam would indicate shortage of refrigerant. Figure 16 illustrates a sectional view of the sight glass.

Expansion Valve

The expansion valve (Fig. 17), a metering and pressure reducing control which regulates the flow of refrigerant to the evaporator, is located in the evaporator housing. It is the dividing point between the high and low pressure sides of the liquid side of the system. Refrigeration begins at this point; it is the coldest point in the system. High pressure liquid enters the expansion valve through the high pressure line and screen. The fine mesh screen in the high pressure inlet prevents dirt and foreign matter from entering the valve orifice.

Three forces operate the valve, spring force, pressure above the diaphragm (from power element) and pressure below the diaphragm (equalizing or back pressure.)

The valve normally operates only during compressor "ON" cycles. During "OFF" cycles, the evaporator



1. Filter 2. Sight Glass

FIGURE 15
SIGHT GLASS AND FILTER LOCATION

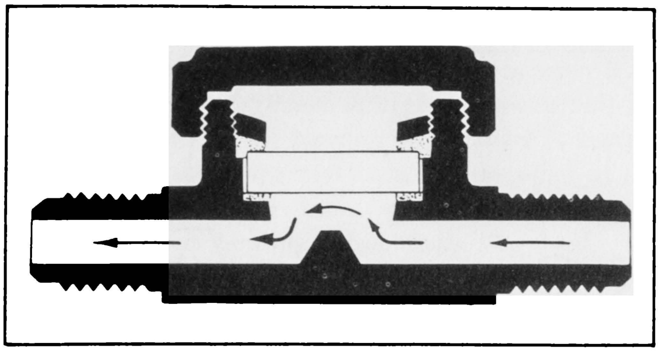


FIGURE 16
SIGHT GLASS

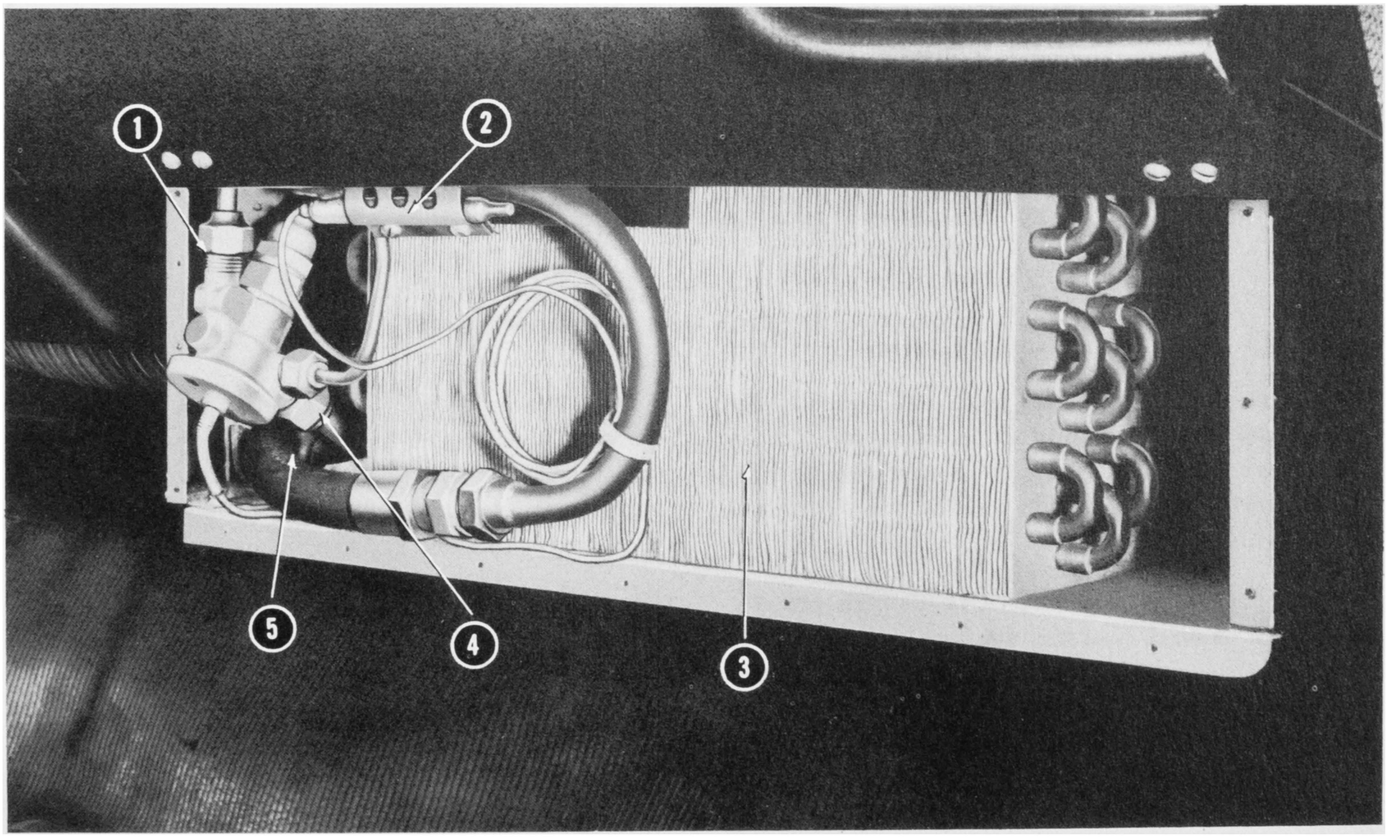
temperature, as sensed by the power element (which contains Freon-12 in a liquid-gas state) attached to the suction line, equalizes the thermal charge pressure (above the diaphragm) and the evaporator pressure allowing the full force of the valve spring to hold the valve closed.

During the "ON" cycle, the valve maintains a constant pressure difference across the diaphragm between the bulb and thermal charge pressure and the evaporator pressure. This pressure difference is determined by the super heat setting and controls the flow of refrigerant to the evaporator. When the temperature at the bulb contact on the suction (low pressure) line rises sufficiently, the thermal charge (expanding) creates enough pressure to overcome the combined evaporator pressure and pressure of the valve spring. The diaphragm then moves against the valve pusher pin and induces the valve ball to open the valve and pass refrigerant to the evaporator.

As the temperature at the bulb contact drops, the bulb thermal charge contracts relieving its pressure on the valve diaphragm. At a point determined by the super heat setting, thermal charge pressure on the diaphragm will be overcome by the opposing evaporator pressure and valve spring pressure. The diaphragm will then be forced to move against the thermal charge and the valve ball will move to the closed position.

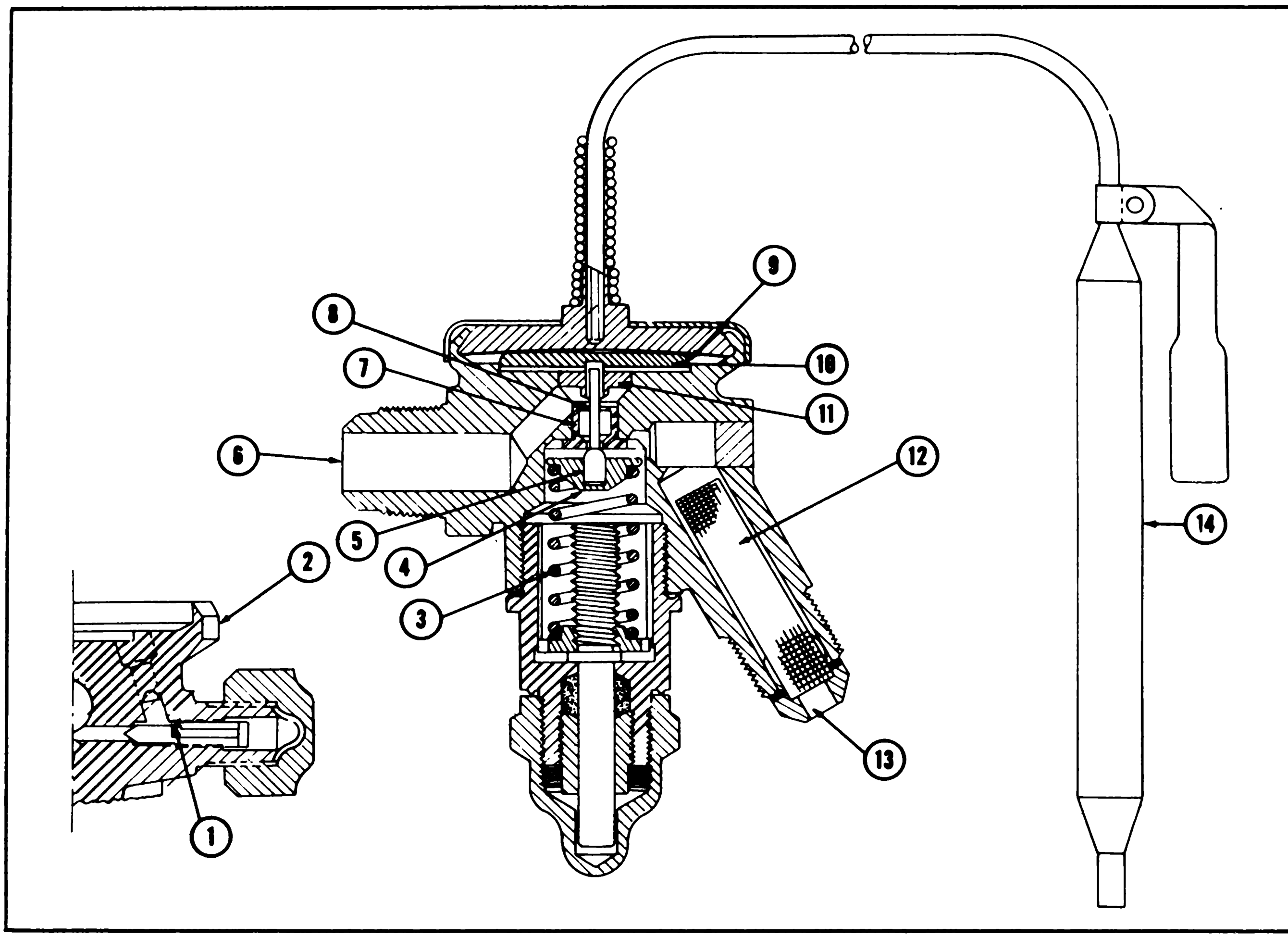
When the thermal charge pressure increases (due to an increase in temperature at the bulb) and/or opposing evaporator pressure drops sufficiently to allow thermal charge pressure on the diaphragm to overcome evaporator pressure and valve spring pressure, the valve will again open.

When the compressor stops, the evaporator and bulb temperature equalize causing the pressures above and below the diaphragm to equalize and the spring closes the valve.



1. Inlet
2. Thermo Bulb or Power Element Location
3. Evaporator
4. Equalizer Connection
5. Outlet

FIGURE 17
EXPANSION VALVE LOCATION



1. Equalizer Screw
2. Equalizer Connection
3. Valve Spring
4. Ball Carrier
5. Valve Ball
6. Outlet Connection to Evaporator
7. Valve Seat
8. Pusher Pin
9. Diaphragm
10. Pusher Plate
11. Pin Guide
12. Strainer
13. Inlet Connection
14. Power Element or Thermo Bulb

FIGURE 18
CUT-AWAY SECTION OF EXPANSION VALVE

During the "ON" cycle, the valve will not actually close completely. A throttling action takes place. Under normal operating conditions, the power element provides accurate control of the quantity of refrigerant to the cooling coil.

The equalizer connection is used in all high capacity systems. It assures operation of the cooling unit at maximum capacity at all times. The liquid control valve must keep the entire interior surface of the evaporator wet with liquid refrigerant at all times, and yet not permit the raw liquid to pass into the suction line.

The expansion valve super heat of eight to ten degrees in the power element is factory set. No attempt to change this setting should be made. The charge in the power element is in the liquid gas state. This is to prevent the frost line from creeping out of the evaporator to the suction line. It also prevents liquid refrigerant from reaching the compressor. Due to the super heat, the power element will react in advance of a temperature and pressure change.

Evaporator

The evaporator is located in the evaporator housing (Fig. 17). The housing is located on the right hand dash panel at the heater opening. The low pressure liquid admitted to the evaporator by the expansion valve, vaporizes due to the heat which it absorbs from the air passing over the evaporator surface. This absorption of heat from the air results in a reduction in the air temperature. It is the only place in the system where the refrigerant is changed from a liquid to a vapor.

Blower Units

The air is drawn into the evaporator unit housing from the passenger compartment through the heater and the return air duct by the blowers. One blower is located directly over the evaporator core and the other at the left hand side of the dash, being connected to the evaporator unit housing by a duct. The fresh ram air admitted to the evaporator from the cowl vent is combined with this air passing over the evaporator core.

Each of the blower fans is encased in a separate housing. The blower fans are the high capacity squirrel cage type. The blower fans are capable of delivering approximately 250 cubic feet per minute at the discharge air grilles on "High" blower.

The air conditioning cycle is completed at this point. The evaporated refrigerant, in a vapor state, carrying the heat removed from the passenger compartment continues back to the compressor through the low pressure suction line. The cycle is again started and repeated.

BY-PASS CYCLE

The continuous cycle of air conditioning has been outlined. If this operation were carried on continuously, the temperature would be drawn down to a very uncomfortable level. A control must be introduced into the system to prevent this condition. Also,

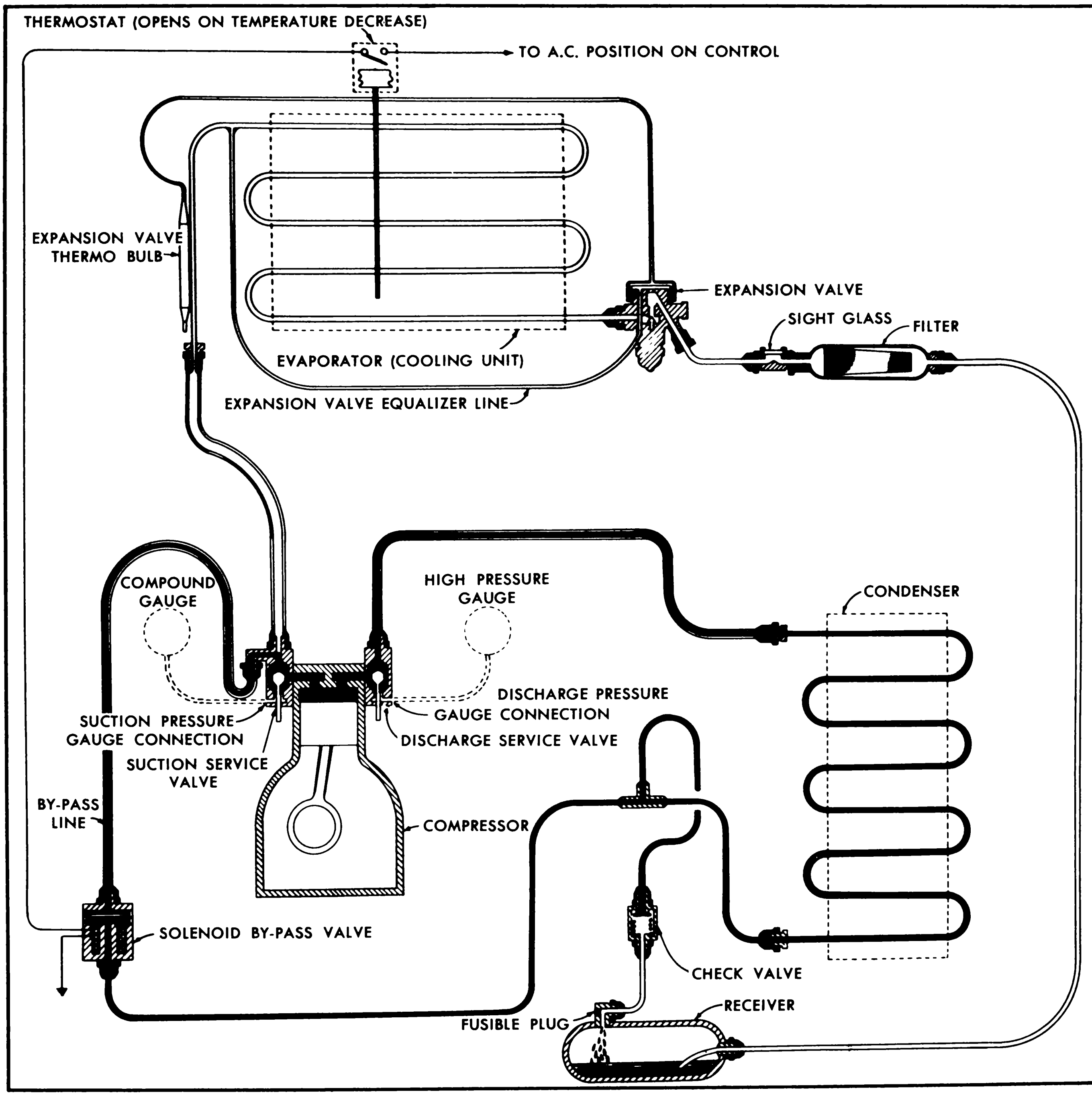


FIGURE 19
BY-PASS CIRCUIT

if the cycle were allowed to run continuously, the evaporator core would frost and eventually block the flow of air over the evaporator and thus cooling would be stopped.

One method to control the amount of air conditioning desired is by the operator's use of the air conditioning switch. To pull the temperature down initially, "High" blower is used. When the temperature is lowered to a comfortable level, "Low" blower is used to maintain a comfortable level in the car.

Another method of control is the automatic by-pass built into the system. The components of this part of the system are the solenoid by-pass valve, temperature control thermostat, and check valve and manifold line (Fig. 19).

During an air conditioning cycle when cooling is required in the car, the solenoid by-pass valve is energized and the by-pass line is closed. The solenoid by-pass is wired in series to the temperature control thermostat and air conditioning switch. When the switch is turned on, the blowers and the solenoid by-pass valve are energized, the valve is closed, and normal air conditioning cycle takes place. When the temperature of the evaporator reaches the frost point, the solenoid by-pass valve is de-energized by the temperature control thermostat and the by-pass line will open. With the by-pass line open, the pressure is reduced on the inlet side of the check valve causing it to close. The refrigerant vapor is then by-passed back to the compressor. The pressures of the high and low side are partially equalized. No refrigerant is directed to the evaporator, therefore, air cooling is reduced at this time (Fig. 20).

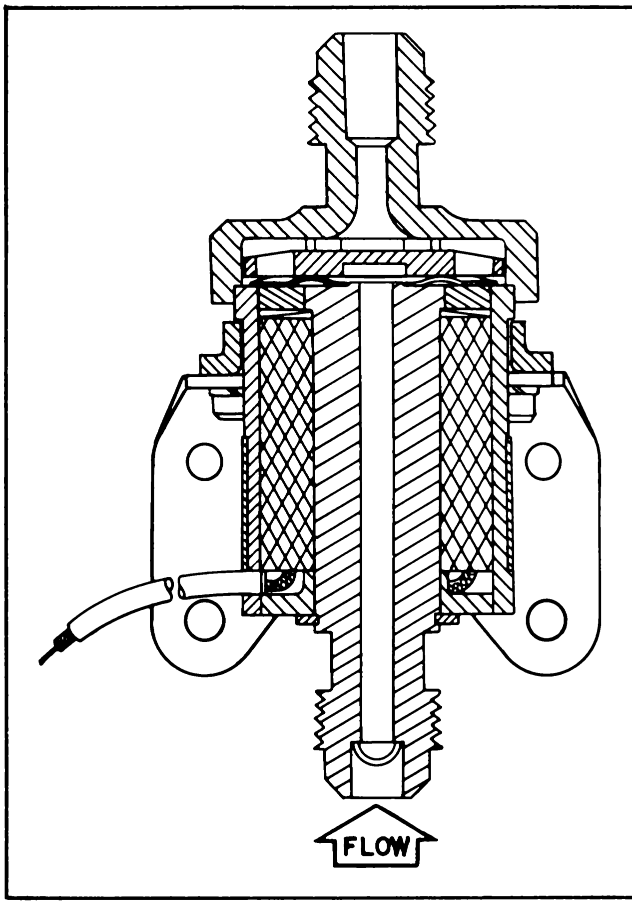


FIGURE 20
SOLENOID BY-PASS VALVE

Check Valve

The check valve prevents liquid refrigerant from entering the by-pass and low pressure lines when the solenoid valve is open. In turn this will prevent liquid refrigerant from entering the compressor during a by-pass cycle (Fig. 21).

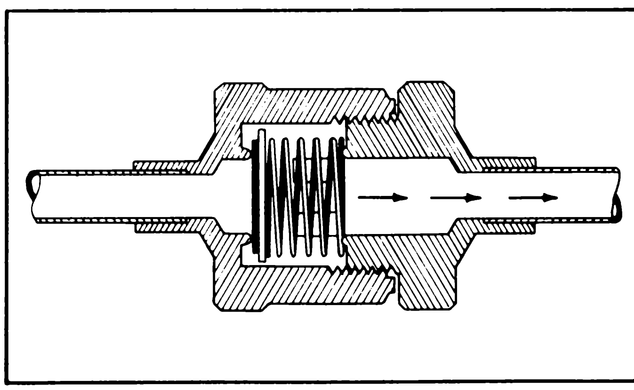


FIGURE 21
CHECK VALVE, ARROW SHOWS DIRECTION OF FLOW

The valve has a spring loaded seat and operates by differences in pressure at each end of the valve. During refrigeration, the check valve is open as the pressure in the condenser is slightly higher than that in the receiver. During the time the system is not refrigerating the pressure in the receiver becomes higher and the check valve closes.

Temperature Control Thermostat

The solenoid by-pass valve is controlled during the refrigeration cycle by the temperature control thermostat located on the top of the evaporator housing.

The capillary sensing tube is located in the coldest section of the evaporator core. The temperature control theromostat is wired in series from the air conditioning switch to the solenoid by-pass valve. This unit is pre-set at the factory and no attempt to adjust it should be made by service personnel.

Temperature Control Thermostat Operation

The temperature control thermostat controls the cycling operation of the system. It also prevents the evaporator core from becoming frosted. By cycling the refrigera-

tion, the evaporator core is allowed to warm up during "OFF" cycles. The temperature control thermostat cuts out at 32°F. as sensed by the capillary tube, the thermostat points are opened and current to the solenoid by-pass valve is closed off. This de-energizes the solenoid by-pass valve and the by-pass circuit is open.

High pressure refrigerant vapor from the compressor passes through the discharge service valve through the line to the condenser. From the condenser it is directed from the by-pass line to the solenoid by-pass valve. It then goes back to the compressor at the suction service valve. As this continues, the pressure partially equalizes on both the high and low side. The thermostat cuts back in at 37°F., the thermostat points are closed and the solenoid by-pass valve is energized and closed, and the normal cycle is again in operation. The normal cycle will continue until the temperature in the evaporator core reaches 32° as sensed by the capillary tube and the by-pass circuit is again used. This method of control will serve to cycle the air conditioning system and prevent the evaporator core from frosting.

Indirectly, it will tend to control the temperature, as the demand for air conditioning is fulfilled, refrigeration is shut down until such time that the mean temperature in the car calls for it again.

Magnetic Clutch

The magnetic clutch is one of the unique features of this system. It is employed to allow the compressor pulley to free wheel when the air conditioner is not being used, therefore, the compressor is not operating needlessly. It also provides the feature that during the winter and off season for air conditioning, it is not necessary to remove the belt from the compressor pulley.

The compressor pulley has a double row ball bearing center bearing held in place by snap rings. The pulley and center bearing is mounted on the crankshaft of the compressor. The bearing inner race is a tight fit to the crankshaft. The pulley has a circular electro-magnet mounted on its forward face. Two circular brass contact rings are on the rear face of the pulley. A brush holder bracket is mounted on the compressor body.

One brush is grounded, the other is connected to the live circuit.

A clutch plate with a splined hub is mounted on the front end of the splined crankshaft. The hub is mounted to the clutch plate by torsional springs. The asbestos clutch plate facing is impregnated with iron filings.

When the air conditioning switch is turned on, current is directed to the contact brush, the electro-magnet is energized, and the clutch plate is held in contact with the compressor pulley. Thus, the compressor is being driven by the clutch plate.

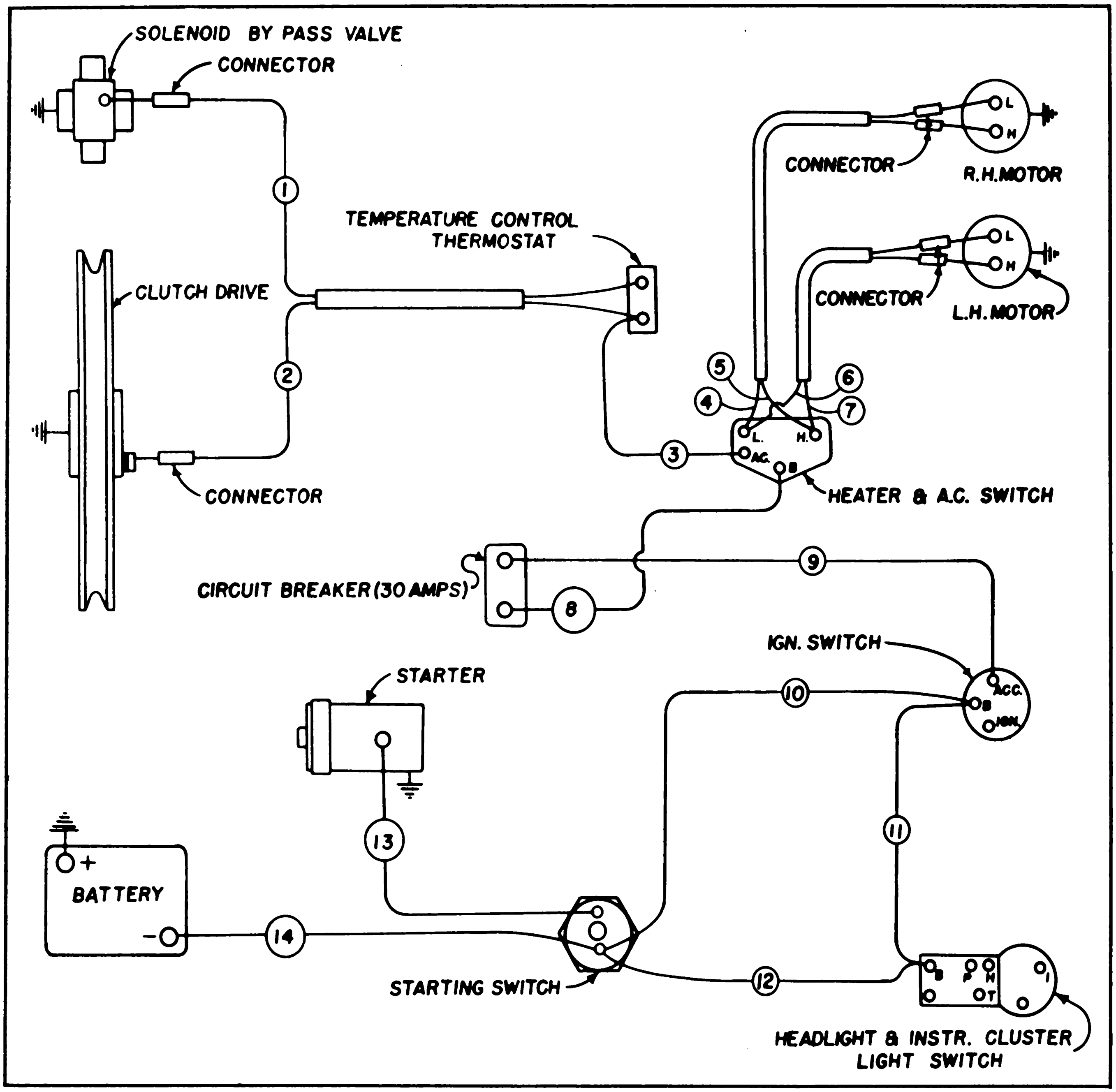
In the "OFF" position of the air conditioning switch, the electro-magnet is not energized and the clutch plate does not contact the pulley. Therefore, the compressor is not being driven as the pulley is free wheeling.

WIRING CIRCUIT

The system is wired so that as the air conditioning switch is turned on counter-clockwise, either to the "Low" or "High" position, the units in the system are energized.

The temperature control thermostat and solenoid by-pass valve are energized simultaneously. The magnetic clutch plate on the compressor drive pulley is also energized and the clutch engages the drive pulley and the compressor starts pumping. Until this was done, the drive pulley has been free wheeling and the compressor has not been operating. The only time, then, that the compressor is operating is when the air conditioning switch is turned on.

The air conditioning switch also controls the blowers for defroster use. The two clockwise positions, "Low" and "High" operate the blower motors and fans (Fig. 22).



1. Solenoid By-pass Valve to Temperature Control Thermostat
2. Magnetic Clutch Plate Brush to Temperature Control Thermostat
3. Temperature Control Thermostat to Air Conditioning Switch
4. Air Conditioning Switch to Right Hand Blower Motor, "Low" Position
5. Air Conditioning Switch to Right Hand Blower Motor, "High" Position
6. Air Conditioning Switch to Left Hand Blower Motor, "Low" Position
7. Air Conditioning Switch to Left Hand Blower Motor, "High" Position
8. Air Conditioning Switch to Circuit Breaker (30 Amps)
9. Circuit Breaker to Ignition Switch
10. Ignition Switch to Starting Motor Switch
11. Ignition Switch to Headlight and Instrument Cluster Switch
12. Headlight and Instrument Cluster Switch to Starting Motor Switch
13. Starting Motor Switch to Starter Motor
14. Starting Motor Switch to Battery

FIGURE 22
WIRING DIAGRAM — "AMBASSADOR" AND "STATESMAN" SERIES

SERVICE INFORMATION AND DIAGNOSIS

The following will outline the various service operations and procedures in servicing the system. Upon diagnosis of the system, any unit or part found faulty in operation will be replaced as a unit. No attempt to adjust any of the units is recommended. Units such as the expansion valve and the temperature control thermostat have been pre-set to operate satisfactorily at the factory. Should these units show malfunction, they should be replaced.

The compressor is to be replaced as a unit. No attempt should be made to disassemble a faulty compressor. The only parts to be removed from the compressor prior to shipment to the factory are the line valves, magnetic clutch, and pulley. Cover plates must be attached to the opening of the compressor to seal it from the atmosphere. Two cap screws are wired and sealed on each removable part as a reminder that compressors are to be returned unopened.

The following operations will be referred to with each service operation in which units or parts are to be removed from the system. In such operations, each will be required to be performed: discharging, evacuating, purging, and charging the system. These will be referred to in each service procedure only as a part of the operation. The following outlines each as a complete operation.

CORRECT HANDLING OF FREON

Use safety glasses to protect eyes as −21.7°F., the boiling point of Freon-12, is a temperature the eyes cannot normally stand. Treat for frostbite if either the eyes or portions of the body are affected. Splash with cold water to raise temperature of affected portion.

Always cap Freon-12 drum when not in use to protect the valve and safety plug from damage.

The drum should never be carried in the passenger compartment. Never leave the drum exposed to sun light or high temperatures. The drums are normally filled to seventy-five to eighty per cent of their capacity to allow for expansion. If the occasion ever arises to fill small drums from a large drum, never fill completely. A full drum will develop hydraulic pressure with a rise in temperature.

Always weigh the cylinder before and after charging, then you can determine the amount of refrigerant in the cylinder.

The drum should never be subjected to high temperature when adding refrigerant to the system. In most cases, heating the drum is required to raise the drum pressure higher than the pressure in the system during the operation. A container of hot water (125°F.) is all the heat that is required. Hot rags also will suffice. Never use a blow torch, or heat the drum on a stove or radiator.

Never discharge the system in an area where an open flame is present. Freon-12 will not produce toxic effects except when combined with a flame. Then poisonous gas will result. Freon vapor will also damage the bright metal surfaces of the car.

Never inhale large quantities of Freon vapor as it will act as an anesthetic.

Before breaking any connections, loosen slightly to be sure refrigerant is not present in a liquid state.

Never permit a cylinder to be dropped or strike another cylinder violently.

Handling of Lines

It is extremely important that refrigerant lines be kept dry and clean. Whenever a connection is to be broken, clean all dirt and grease from the connection.

Parts from stock are capped and dehydrated; the caps should be removed only prior to installation. Lines removed from the system to be used again should be capped immediately to prevent dirt and moisture from entering the line. If caps are not available, copper lines can be placed in an oven for a period of two or three hours before again installing in the system. Bake at 275° to 300°F. The same is possible with units in the system, such as the evaporator core, condenser, compressor, filter, receiver, and sight glass. The expansion valve can be baked at 100° to 125°F. for two to three hours. This process will insure against moisture in these items. The rubber lines should be baked at 200°F. for two hours.

The lines should be free of kinks that will cause restrictions to the flow of refrigerant. The lines should be carefully stored to avoid crushing or bending.

The proper size wrenches should be used in tightening fittings. Always use two wrenches when tightening fittings to prevent twisting the soft copper tubing. Tubing that is left free to vibrate will harden and crystallize the area of the tube at the flare section so that it may become brittle and break (Fig. 23).

Gauge set and lines should be kept clean and free of moisture.

The compressor lubricant container must not be left open longer than necessary as the special oil is mois-

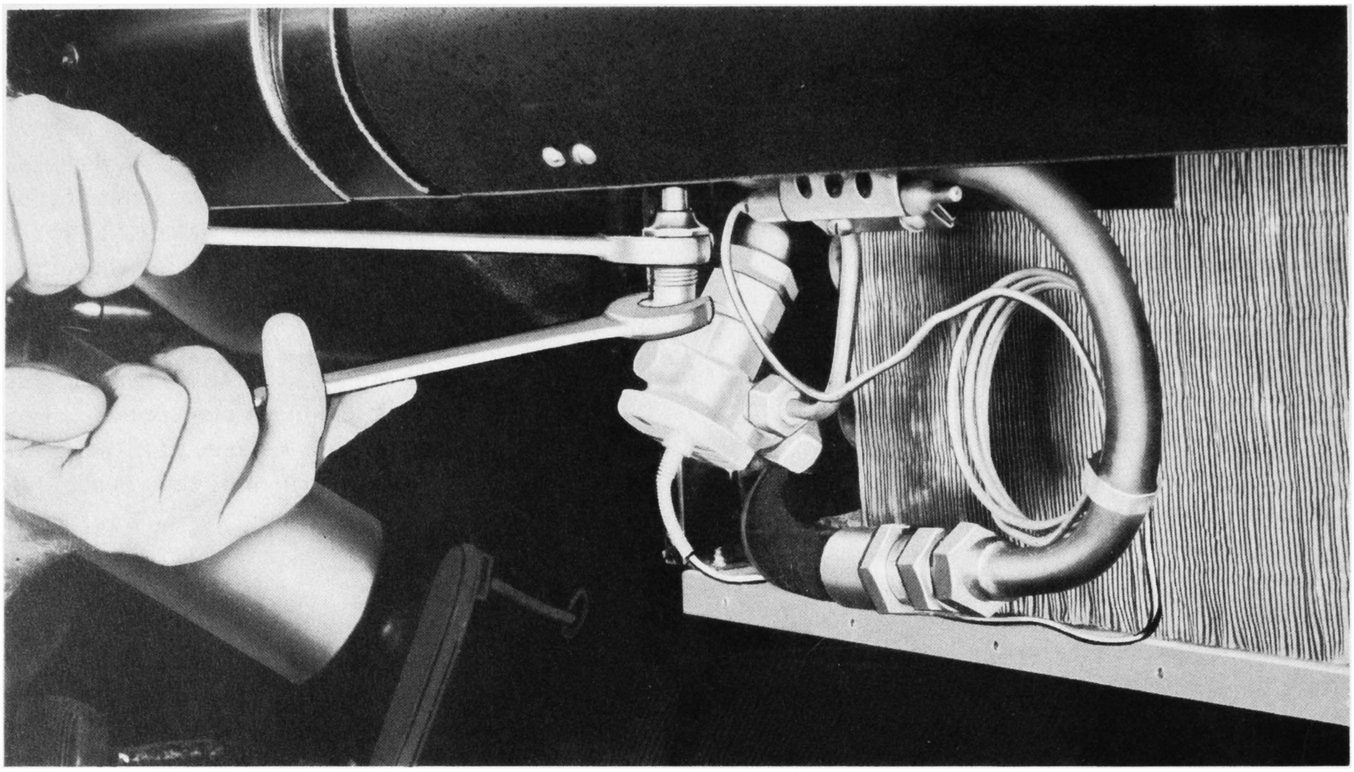


FIGURE 23
PROPER METHOD OF BREAKING A CONNECTION

ture free and will absorb moisture from the air if left uncapped.

GAUGE SET

The gauge manifold set, Tool J-5725, is a multi-purpose tool and can be used to advantage in servicing the system. In addition to being used in charging a system, it can be helpful in diagnosis of the system (Fig. 24).

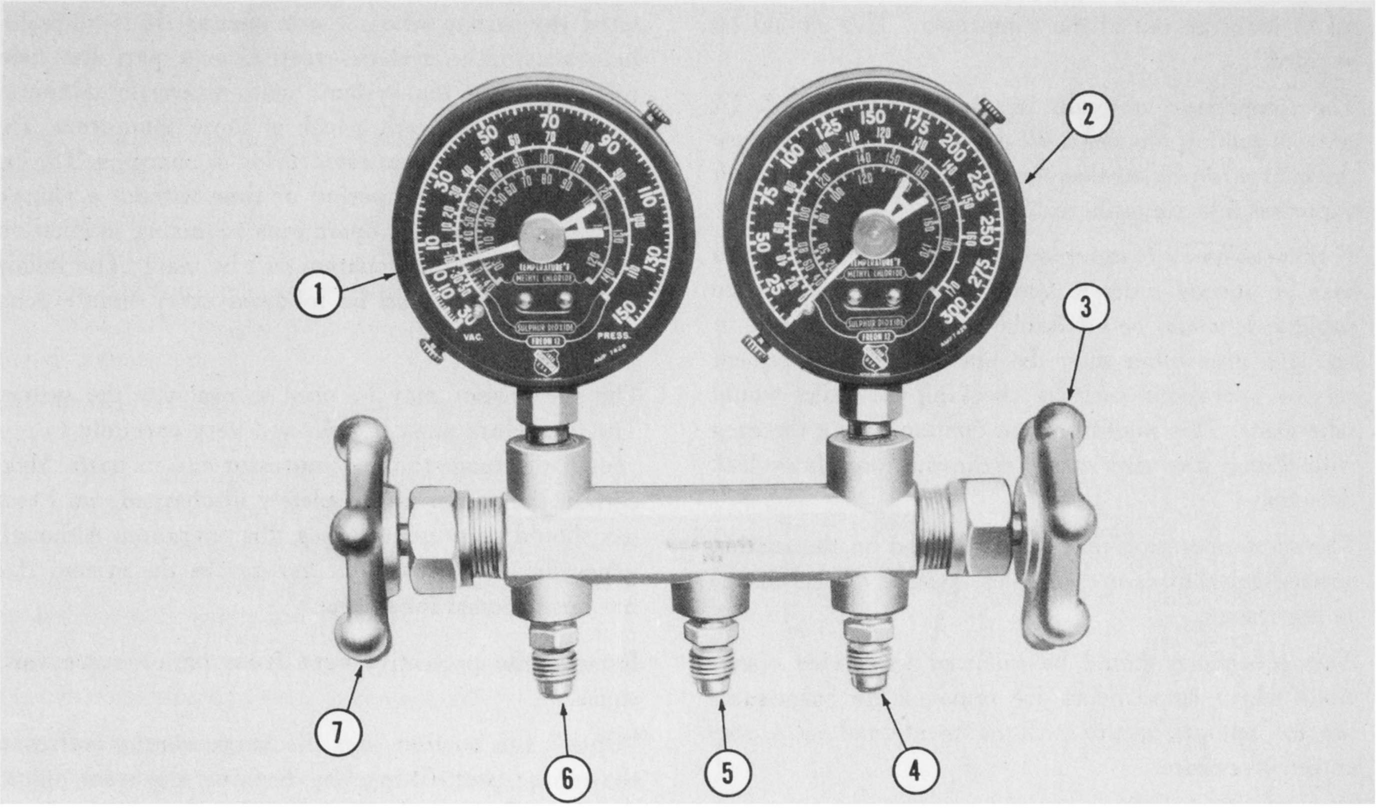
A compound gauge that reads from 0 to 150 pounds pressure and 0 to 30 inches vacuum is on the left hand side of the manifold. This gauge is used to read pressures for the low pressure side of the system and vacuum when used for evacuation. The compound gauge will have its gauge pointer at 0 when at atmospheric or room temperature; the pointer can move in either direction along the scale from 0 depending on which use it is put to. The low pressure side should never go below approximately 20 pounds pressure when the system is functioning properly. However, abnormal conditions could occur that the low pressure side may go into a partial vacuum so the use of a compound gauge is necessary. The compound pressure gauge should never be connected to the high pressure side (discharge) service valve.

The high pressure gauge is on the right hand side of the manifold. It is graduated from 0 to 300 pounds pressure and is used to check pressure on the high pressure side of the system only.

For convenience of field use, atmospheric pressure at sea level is called 0 gauge. In other words, gauges read 0 at an actual pressure of about 14.7 pounds per square inch absolute. This enables one to tell by a glance at the gauge whether the pressure in a system is above or below that of atmosphere and also just how much above or below without having to refer to the figure 14.7.

These gauges have four scales on their face. The outside scale is the pressure scale. The other three are marked Freon, Methyl Chloride, and Sulphur Dioxide and are graduated in degrees Fahrenheit. For any given pressure in the system shown on the outside scale, the refrigerant saturated temperature for any of the three named gases can be found by reading where the pointer crosses the scale marked for that refrigerant. This saves the operation of looking it up in a table if that information is desired.

The connection on the left is for attaching the low pressure gauge line which in turn is attached to the gauge port on the suction service valve. The one on the right is for the high pressure gauge line which is attached to the discharge service valve gauge port. The center connection is for the purpose of attaching a line for evacuating, adding refrigerant, and discharging. This connection is common to the other two connections. If the gauge set is used to diagnose pressures while the system is in operation, it should be capped.



1. Compound Pressure Gauge
2. High Pressure Gauge
3. High Pressure Hand Valve
4. High Pressure Connection
5. Service Connection
6. Low Pressure Connection
7. Low Pressure Hand Valve

FIGURE 24
GAUGE MANIFOLD SET TOOL J-5725

The hand shut-off valves do not close off pressure to the gauges. They close each opening to the center connection and to each other.

Use of Gauge Manifold Set

The gauge set as used in evacuating and charging procedures are outlined in these respective sections.

To use the gauge in diagnosis of pressures in the system or any further problems, hook up in the following manner:

Close both hand valves on gauge manifold set.

Attach a gauge line to the high pressure connection on the manifold.

"Open" the discharge service valve and remove the cap from the gauge port and attach gauge line.

Cap the center connection.

Attach a gauge line to the low pressure connection on the manifold set.

"Open" the suction service valve and remove the cap from the gauge port and attach gauge line.

"Crack" the service valves.

Without the system operating, both the gauges should read the same. The system is in the by-pass cycle and the pressures on the high and low side are equalized. For example, if the ambient temperature is 70°, the pressure readings on both gauges should read 70 pounds gauge pressure. Reference to the temperature-pressure relation curve will give readings for other temperatures. You will note that by reading the Fahrenheit scale on the gauge for Freon-12 and the pressure scale, the readings will correspond to the temperature-pressure relation curve.

To further use the gauge set while road testing the system, long copper tubes to replace the lines can be fabricated to enable the operator to have the gauge set in the car. This way he can observe the gauges to check the system at various speeds. Experience with the system and gauge set will eventually enable service personnel to recognize malfunction of parts in the system.

DISCHARGING THE SYSTEM

"Open" the discharge service valve by backing the stem out all the way.

Remove the cap from the gauge connection. Open the system to the atmosphere by turning the valve stem in one to three turns. Rapid release will cause the

oil to foam up out of the compressor. This should be avoided.

The compressor lubricant is soluble in Freon-12. To prevent pulling too much oil out of the system, release the charge slowly so that the oil remains as the Freon vaporizes into atmosphere.

If there is no oil foaming out with the Freon, the valve may be opened wider to allow the gas to escape more rapidly. It would be advisable to release the charge in an open area other than the one wherein subsequent service operations such as checking for leaks would take place. This would prevent contaminating the area with Freon gas and cause erroneous and false leak detection.

The same operation may be performed on the suction service valve to assure complete release of the charge in the system.

This procedure should be followed in service operations where components are removed. In subsequent service operation, this will be mentioned as a step in the procedure.

EVACUATING THE SYSTEM

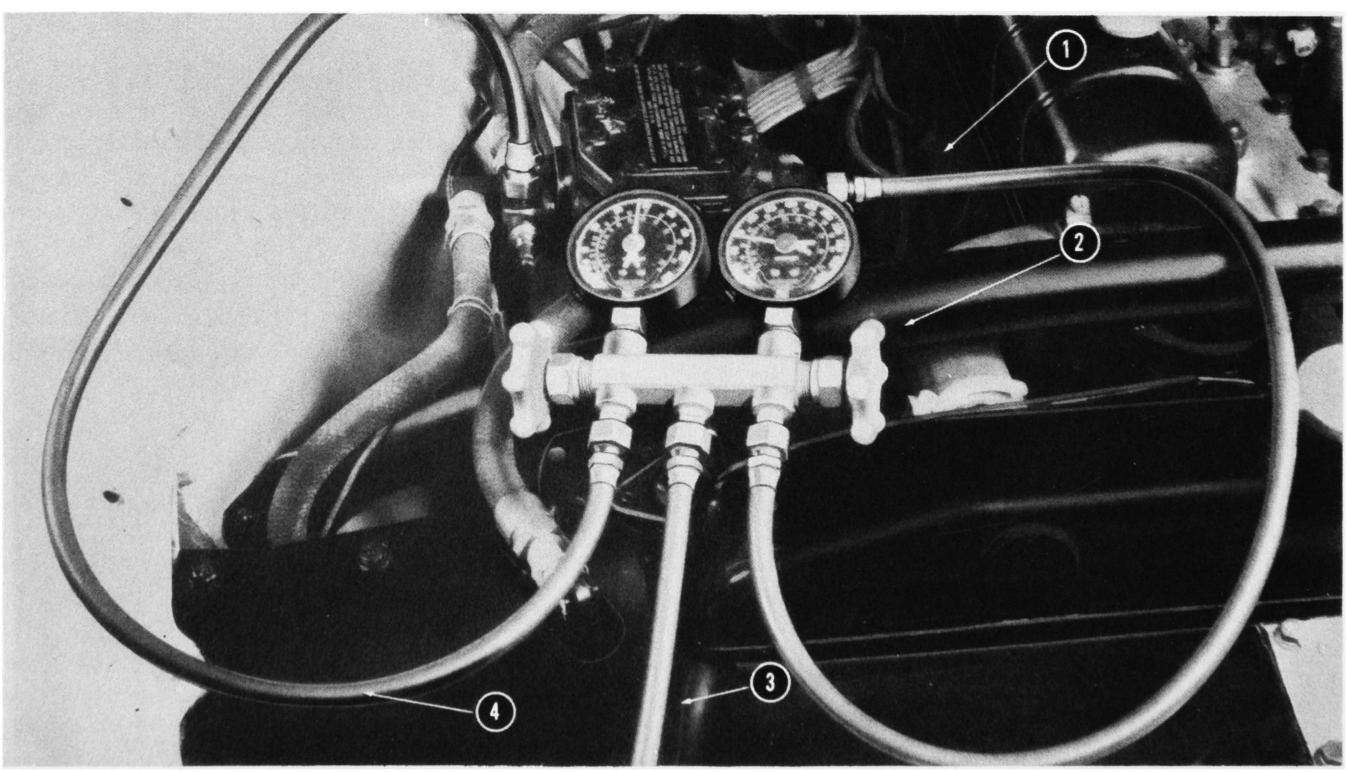
The system should be evacuated every time it has been opened for a service operation such as a replacement of a part or line. Air and moisture may have entered the system when it was opened. It is advisable to evacuate the system every time a part has been removed from the system; also, whenever a charge has been lost through a leak or loose connection. The system should be evacuated prior to charging if it has been standing for a period of time without a charge. In discussing service operations requiring evacuation, only reference to evacuation will be made. The following procedure should be followed every time evacuation is necessary.

The compressor may be used to evacuate the system. The procedure must be followed very carefully to prevent any damage to the compressor and its parts. Make certain the system is completely discharged; no Freon gas should be present during this operation. Although, generally, there would be no gas in the system if it has been opened for service.

Remove the protective caps from both service valve stems.

"Open" the suction and discharge service valves to the gauge port fittings by backing the stem out all the way. Remove the protective caps from the gauge port fittings.

Install gauge line, Tool J-5418, from suction service valve port to compound gauge fitting on the gauge manifold set, Tool J-5725 (Fig. 25).



1. Gauge Line, Discharge Service Valve to Pressure Gauge
2. Gauge Manifold Set
3. Gauge Line, to Atmosphere or Freon Drum for Charging
4. Gauge Line, Compound Gauge to Suction Service Valve

FIGURE 25
INSTALLATION OF GAUGE SET, TOOL J-5725

Install the gauge line from discharge service valve port fitting to the high pressure gauge fitting on the gauge manifold set.

Install gauge line to the center connection on the gauge manifold set.

The hand valve on the compound gauge is closed to the center connection of the gauge manifold set. The compound gauge will still register low side pressure. The hand valve on the pressure gauge is open to the center connection.

The suction service valve is moved to the "Cracked" position by turning the valve stem in two to three turns. The discharge service valve is "Closed" by turning the valve stem in all the way. The discharge service valve gauge port is open to the atmosphere through the open hand valve on the gauge manifold set and the open gauge line (Fig. 26).

The gauges both should register "0" at this time as there is no pressure present in the system.

The discharge service valve being closed and with the gauge port open, air pumped out by the compressor is exhausted through the open gauge line attached to the center connection. With the discharge service valve closed, the system is closed off so that as the compressor pumps the system is evacuated back to the closed valve.

Check the oil level in the compressor.

Start the engine and operate the compressor for a minute or two at a time for three or four times to slowly reduce the internal pressure. Then run continuously observing the compound gauge. If the compressor is efficient, it should pump down to 26″ to 28″ vacuum quickly.

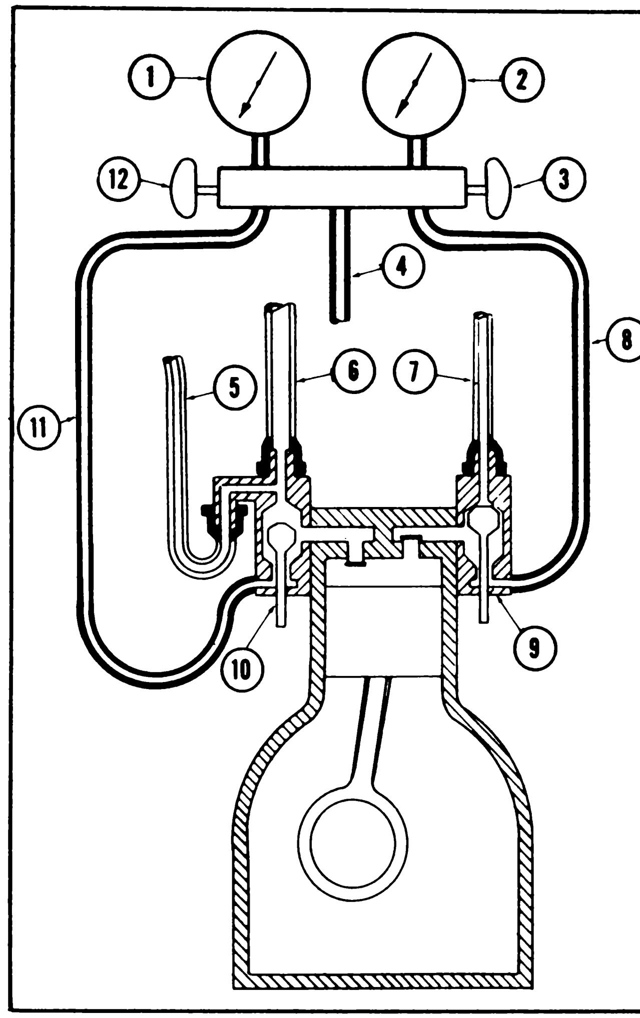
IMPORTANT: DO NOT RUN MORE THAN TEN TO FIFTEEN MINUTES AS IT IS POSSIBLE TO DAMAGE THE COMPRESSOR.

If a 26″ to 28″ vacuum cannot be reached, the compressor is evidently defective or a leak is present in the system. Evacuation also dehydrates since it removes most of the moisture bearing air.

After pumping a good vacuum for ten to fifteen minutes, close the hand valve on the high pressure gauge on the gauge manifold set and immediately shut the system off and stop the engine. There should only be a brief interval between these two operations.

Return the discharge service valve to the "Cracked" position by turning the valve out two to three turns. Both the hand valves on the gauge manifold set remain turned off.

At this time, the vacuum reading on the compound gauge should remain constant; it should read from 26″ to 28″ vacuum. Let the system stand for about ten to fifteen minutes and if the vacuum remains constant, the system is sealed from the atmosphere. If the vacuum drops off, there is probably a loose connection or leak in the system. Correct by tightening or replacing the leaking part and repeat the procedure.



1. Compound Gauge
2. High Pressure Gauge
3. High Pressure Gauge Hand Valve — "Open" Position
4. Gauge Line, Center Connection, Open to Atmosphere
5. By-pass Line
6. Suction Line — Evaporator to Compressor
7. Discharge Line — Compressor to Condenser
8. Gauge Line, High Pressure Gauge to Discharge Service Valve
9. Discharge Service Valve "Closed" Position
10. Suction Service Valve "Cracked" Position
11. Gauge Line, Suction Service Valve to Compound Pressure Gauge
12. Compound Pressure Gauge Hand Valve "Closed" Position

FIGURE 26
EVACUATION OF AIR CONDITIONING SYSTEM

Heat a Freon drum with a four pound charge in a container of hot water (125°) or with rags soaked in hot water. Then attach the drum to the center connection gauge line.

Loosen the gauge line fitting to the center connection slightly. Crack the drum valve, purging air from the gauge line with Freon vapor. Tighten the gauge

fitting and close the drum valve.

Open the hand valve on the pressure gauge side of the gauge manifold. With the drum in the upright position, crack the drum valve slightly to admit the vaporized Freon gas from the top of the drum into the system.

Close the drum valve.

The internal pressure will record on both gauges; this pressure should be approximately room temperature of 70° which gives the equivalent pressure of 70 pounds.

The system is completely tested for leaks (follow "Leak Test Procedure") with a Halide leak detector, Tool J-5419. Eliminate any leaks present by tightening connections and replacing leaky part and repeat entire procedure up to this point.

The system may now be charged with refrigerant following the procedure outlined in "Adding Refrigerant — Complete Charge".

CHARGING THE SYSTEM

The normal charge of refrigerant for the system is four (4) pounds of Freon-12.

For every pound of Freon-12 in the system, 2 c.c. of Methanol are added to the Freon-12. Some systems employ dehydrators or drying agents to absorb moisture that may be in or get into the system. Moisture is not soluble with Freon-12, but with the addition of Methanol to lower the freezing point, the moisture will pass through the system. Without Methanol, moisture would freeze and block the system particularly at the expansion valve orifice where the high pressure liquid is metered into a low pressure liquid.

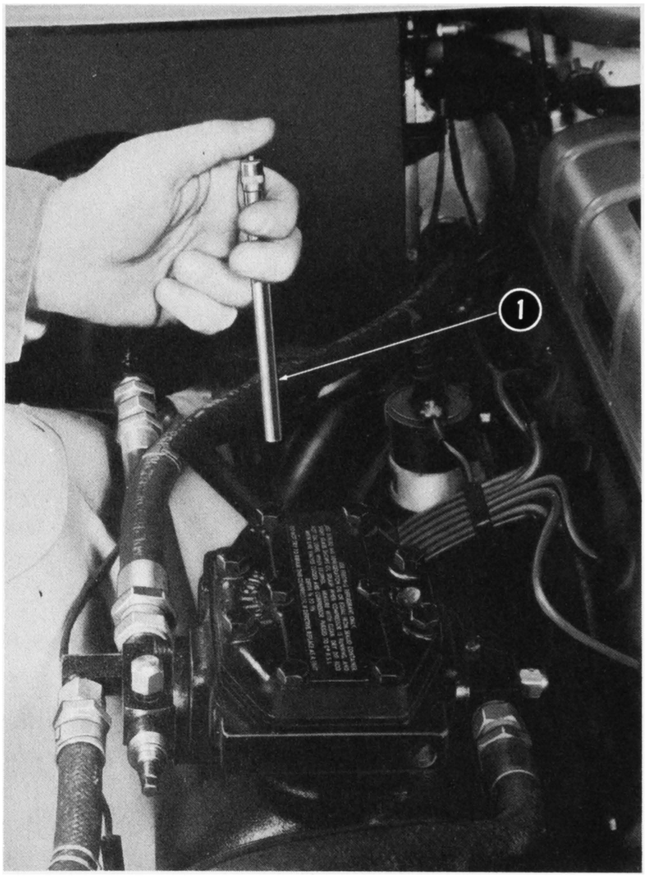
This is the coldest point in the system. Although the system is controlled to 32°F., it is entirely possible to go a few degrees below before the temperature control thermostat would cycle the system into the by-pass circuit.

NOTE: Refer to "Moisture and Air" in the System for additional information.

The sight glass provided in the liquid line is used to check the system for a normal charge. Bubbles of vapor passing through the sight glass would indicate a low or short charge of refrigerant (Fig. 27).

In a correctly charged system, the liquid level in the receiver covers the liquid outlet tube to prevent hot gas from going to the evaporator. The receiver is normally 50 to 60 per cent filled with liquid.

There is no actual way of determining how much refrigerant is required if the sight glass is checked and vapor bubbles are present.



1. Flash Light

FIGURE 27
CHECKING SIGHT GLASS

Adding Refrigerant — Partial Charge

This operation is only performed when part of the charge is lost through a leak.

Leak Test (refer to Leak Test Procedure). Correct conditions as required.

"Open" both the suction and discharge service valves to the service port fittings by backing the valve stem out all the way.

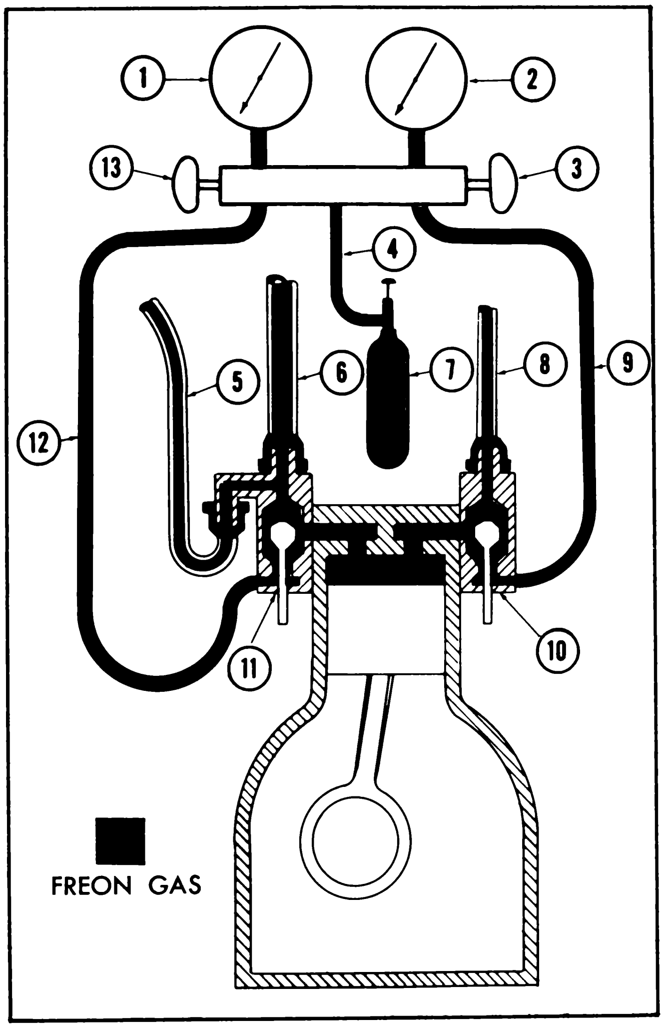
Remove the cap from the discharge service valve port fitting and install a gauge line, Tool J-5418, to the fitting and to the high pressure gauge fitting on the gauge manifold set, Tool J-5725. Remove the cap from the suction service valve port fitting and install a gauge line to the fitting and to the compound gauge fitting on the gauge set.

Close the gauge hand valves to the center gauge fitting.

Install a gauge line to center fitting on the gauge set.

Install gauge line to Freon drum. Check all connections to see that they are tight.

NOTE: An important rule to follow in charging is that the refrigerant should always be in a vaporous state when added to the low side. The Freon drum will require the use of heat in order to charge the refrigerant into



1. Compound Gauge
2. Pressure Gauge
3. Pressure Gauge Hand Valve — "Closed" Position
4. Gauge Line, Center Connection to Freon Drum
5. By-pass Line
6. Suction Line — Evaporator to Compressor
7. Freon Drum (4 Pound Charge) — "Upright" Position
8. Discharge Line — Compressor to Condenser
9. Gauge Line, High Pressure Gauge to Discharge Service Valve
10. Discharge Service Valve — "Cracked" Position
11. Suction Service Valve "Cracked" Position
12. Gauge Line, Suction Service Valve to Compound Gauge
13. Compound Gauge Hand Valve—"Open" Position

FIGURE 28
ADDING PARTIAL CHARGE OF REFRIGERANT

the system in a vaporous state. A bucket of hot water, 125°F., is adequate. This will cause the liquid to vaporize as it leaves the drum. Hot rags wrapped around the drum will also serve to vaporize the refrigerant.

With the drum in the upright position, open the drum valve slightly.

Open the gauge hand valves on the gauge set; this will open the center charging line to each charging line to the compressor.

Both service valves are to remain closed to the gauge fittings. Loosen the flare nut connections of the charging lines at the service valves to purge air from the lines and gauge set. These should only be cracked open momentarily. Air will be purged or driven out by the Freon vapor. Retighten the connections.

Close the hand valve on the high pressure gauge on the gauge set. This will close the gauge to the center fitting. The gauge will still record pressure on the high side when the compressor is running with the charge installed.

Open the discharge service valve on the compressor by turning the valve stem in three to four turns to the "Cracked" position. Also open the suction service valve to the "Cracked" position in the same manner.

The Freon drum valve has been cracked slightly until this time. With the drum in the upright position open the valve completely.

Operate the engine and compressor at a slow idle speed.

Observe the sight glass until a solid liquid column appears (Fig. 27). Then add approximately ½ pound additional refrigerant.

Close the drum valve.

Operate the engine for five minutes at approximately 1500 to 1800 R.P.M.

Observe gauges, sight glass, and entire system for proper performance.

After the unit operates satisfactorily, stop the engine, close the service valves to the service valve port fittings by backing the stems out all the way, disconnect lines, cap the fittings, and leave the service valves in this position.

Adding Refrigerant — Complete Charge

This operation is performed after a part has been removed from the system or the complete charge has been lost through a leak.

Check all connections to see that the flare nuts are tight.

"Open" both the suction and discharge service valves to the service port fittings by backing the valve stem out all the way.

Remove the cap from the discharge service valve port fitting and install a gauge line, Tool J-5418, to the port fitting and to the high pressure gauge fitting on gauge manifold set, Tool J-5725. Remove the cap from the suction service valve port fitting and install a gauge line to the fitting and to the compound gauge fitting on the gauge set. Close the gauge valves to the center gauge manifold fitting.

Install a gauge line to the center fitting on the gauge manifold.

Evacuate the system (refer to Evacuation Procedure).

After evacuation, install gauge line to Freon drum. Check all connections to see that they are tight.

Common size of refrigerant drums are 3, 5, 10, 25, 50, and 145 pounds. The drums are ordinarily marked with their tare weight, which is the weight of the cylinder when empty. Weighing a cylinder containing refrigerant, then subtracting the tare weight, gives the weight of the contained refrigerant. The specified complete charge for the system is four (4) pounds of Freon-12. To determine the amount of refrigerant used, weighing the cylinder before and after charging would enable you to determine the amount used.

Place the drum in the upright position; open the drum valve slightly.

Open the gauge hand valves on the gauge manifold set. This will open the center gauge line to each gauge line to the compressor.

The service valves are closed to the gauge port fittings. Loosen the flare nut connections of the gauge lines at the gauge port fittings on both service valves. This will serve to purge the air from the gauge lines and gauge set. These should only be cracked open momentarily. Air will be purged or driven out by the Freon vapor. Retighten the connections.

Close the hand valve on the compound gauge of the gauge set. This will close the gauge to the center fitting and to the high pressure gauge. The gauge will still record pressure when the compressor is running.

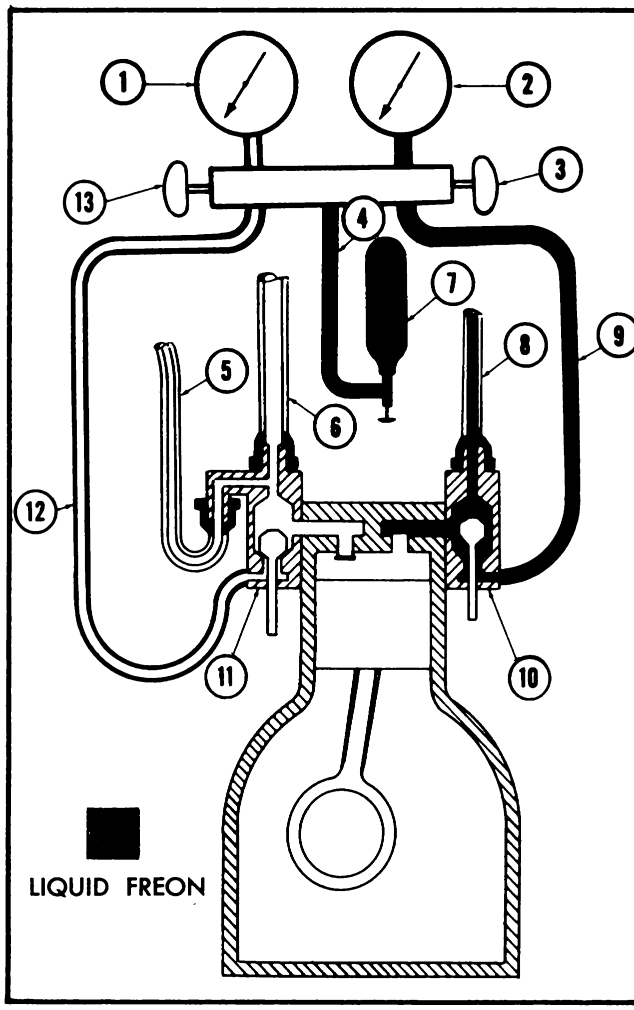
Open the discharge service valve to the "Cracked" position. The suction service valve remains closed.

Previously, the Freon drum valve had been cracked open slightly. At this time, it may be opened all the way. Heat may be applied to the drum as outlined in the procedure of Partially Charging the System.

Charging with liquid refrigerant is done at the high side of the compressor at the discharge service valve. The compressor should not be running after heat has been applied to the drum; it can be held in an inverted position so the vapor goes to the top of the drum and exerts pressure on the liquid and forces it into the system. The liquid refrigerant goes through the condenser and into the receiver (Fig. 29).

Close the drum valve after the complete charge is in the system. This can be readily determined by the stopping of the hissing noise as refrigerant is fed into the system. Close the hand valve on the high pressure gauge on the gauge set.

Open the suction valve to the "Cracked" position.



1. **Compound Gauge**
2. **High Pressure Gauge**
3. **High Pressure Gauge Hand Valve — "Open" Position**
4. **Gauge Line, Center Connection to Freon Drum**
5. **By-pass Line**
6. **Suction Line — Evaporator to Compressor**
7. **Freon Drum (4 Pound Charge) — Inverted Position**
8. **Discharge Line — Compressor to Condenser**
9. **Gauge Line, High Pressure Gauge to Discharge Service Valve**
10. **Discharge Service Valve — "Cracked" Position**
11. **Suction Service Valve — "Open" Position**
12. **Gauge Line, Suction Service Valve to Compound Gauge**
13. **Compound Gauge Hand Valve — "Closed" Position**

FIGURE 29
INSTALLING COMPLETE CHARGE OF REFRIGERANT

Turn air conditioner on "High" blower. Run the engine at 1500 to 1800 R.P.M. Observe the sight glass and the high and low pressure gauges. The engine should run from ten to fifteen minutes to normalize the system.

If no bubbles appear at the sight glass and the pressures are normal, shut off the engine.

NOTE: Head pressure (high side) should not exceed 275 pounds at normal room temperatures.

Excessive head pressure would indicate air or excessive charge in the system. Purge the air from the system or release excessive charge. This method is outlined in the section on Air and Moisture in the System.

Leak test the system. Correct as required (refer to Leak Test Procedure).

If the system operates normally, close the service valves to the gauge port fittings.

Remove the gauge lines and cap the gauge port fittings.

CHECKING AND ADDING OIL

In normal operation, a small amount of oil is always circulating throughout the refrigerating system. An oil sight glass is provided in the compressor so that you can see if the oil is splashing when the compressor is running. It does not indicate the oil level when the compressor is stopped. The oil level is determined by stopping the compressor and closing the suction and discharge service valves to the lines. This isolates the compressor from the rest of the system and leaves the system sealed from the atmosphere.

Loosen the gauge port cap on the discharge service valve slightly and let the gas in the compressor purge to the air slowly until the suction pressure gauge shows 0 pounds. Relieve the crankcase pressure by loosening the oil filler plug slowly and remove it when oil has stopped foaming. The oil level should be 7/8″ when measured with a dip type rod.

Add oil to bring it to the recommended level if necessary. Use Suniso 4-G or 300 Seybolt refrigerant oil. To avoid adding too much oil, add slowly and check with dip rod.

Replace oil filler plug.

"Open"the suction service valve slightly for approximately a few seconds until a hissing sound is heard from the valve to allow the system to purge air from the compressor through the discharge service port.

Tighten the discharge service valve port cap.

After the air has been purged from the system;"Open" the service valves.

Install valve stem caps; operate system and allow to run a few minutes. Observe the oil splash in the sight glass of the compressor. There should be oil splash if there is sufficient oil in the system.

NOTE: The refrigerant charge should be checked whenever oil is added to the compressor.

CAUTION: The oil in the container originally is packed moisture free and every effort should be made to maintain its status. The oil will quickly absorb any moisture with which it comes in contact. The container should not be opened until ready for use, and be recapped immediately after use. Tools, tubes, gauge sets, and replacement parts should be kept clean. The system should not be open any longer than absolutely necessary.

Oil Level When Replacing Compressor

Precautions should be taken to prevent an over or under charge of oil whenever the compressor is replaced. The oil charge in a new compressor is sufficient for an entire system. In a system that has been running, there is always some oil circulating through it.

Purge the gas pressure in the crankcase of the original compressor to 0 pounds pressure slowly after the line valves are closed.

Check the oil level without running the compressor. Running the compressor will cause a sudden drop in pressure in the crankcase and may cause oil pumping. The oil level in the crankcase would then be temporarily lowered putting an over charge of oil in the evaporator so a false reading is obtained when checking the oil level.

Check the oil level in the new compressor and add or remove oil from it until the oil level is the same as it is in the compressor to be replaced or 7/8″.

After the new compressor has been run for ten or fifteen minutes, recheck the oil level.

MOISTURE AND AIR IN THE SYSTEM

Presence of air and moisture in the system is harmful. Precautions should be exercised to prevent both from entering the system. Moisture and air often enter together because in all air there is more or less water vapor along with the oxygen, nitrogen, and other gases of which air is composed. Moisture and air may enter through leaky shaft seals, faulty tubing connections, defective gasket joints, and other leaks. It can get in during service operations which are incorrectly performed and during installation of equipment. Water or moisture may enter with refrigerants or oil which have been allowed to gain water through contact with air. As a precaution, the compressor oil container should only be opened when in use; the cap should not be left off for any length of time.

Water causes the most serious troubles. Water does not dissolve to any great extent in Freon-12 but tends to separate and remain apart from the refrigerant. Consequently, the separated water is likely to freeze into ice and clog the small openings in the expansion valve. Ice in the expansion valve orifice stops flow of

refrigerant. Then the evaporator and valve warm up, the ice melts, and refrigeration once more takes place — only to be stopped again as more ice forms. Such intermittent refrigeration is an indication of excessive water in the system. Clogging due to particles of dirt reduces or stops refrigeration completely until the dirt is removed. Clogging due to water is intermittent while that due to dirt is permanent or continuous.

Freon-12 will slowly Hydrolyze; that is, react with water to form Hydrochloric acid or Hydrofluoric acid. This quickly and seriously corrodes the metals used in the system. Freon itself has no corrosive action upon the metals used in the system, but the aforementioned reaction with water will corrode the metals. Corrosive particles in turn break loose and damage the system.

Water emulsifies with lubricating oil, meaning the two form an intimate mixture of exceedingly fine globules of the liquids. This effect is called "sludging" of the oil and greatly reduces the lubricating ability of the oil. Water in a refrigeration system tends also to make diaphragms and bellows lose their elasticity and become harder and more brittle.

The best insurance against moisture is to prevent it from entering the system.

This can be done by keeping all components sealed prior to installation and during repair procedures. Should the system be opened for a service operation, seal the openings and lines with plastic caps. Follow the procedure outlined in Handling of Lines to rid any of the parts of suspected moisture.

This system employs the use of Methanol to prevent water in the system from freezing. Four pounds of Freon-12 is the normal charge with 2 c.c. of Methanol per pound. This would lower the freezing point of the water that may be in the system. An excessive amount of water may upset the balance, and if the symptoms of water are present, corrections are necessary. Release the charge, evacuate the system, and recharge. Water will be evaporated during the evacuation process. Also, any air that may be pocketed in the system will be evacuated at the same time.

Air which consists of gases that cannot be condensed in the refrigeration system causes excessively high pressures in the high side of the system and reduces the operating efficiency.

Install gauge set and operate to determine pressures.

The presence of air is always indicated by high operating head pressure. (The pressure should normally not exceed 275 P.S.I.)

This also could be confused with an excessive amount of refrigerant which would also indicate high head pressure; although an excessive amount of refrigerant would still give adequate cooling effect.

No matter where or how air enters, it will always end up in the condenser. Air mixes with the refrigerant vapor in the condenser and takes up valuable condensing space.

If the system is known to have the correct amount of refrigerant, but during operation and using the gauge set the head or high pressure builds up, air is certain to be in the system.

PURGING AIR FROM THE SYSTEM

Allow the system to remain idle several minutes after the compressor has been operating.

The air then may be released through the discharge service valve on the compressor. This is done by first making sure that the valve is shut off to the gauge port, then remove the gauge connections. Turn the valve stem in toward the cracked position for a few moments, thus allowing air to escape through the gauge port.

Cover the port opening with a cloth when purging the system of air to prevent refrigerant and oil from contacting persons or car.

This procedure should be repeated if it is apparent that air is still in the system. Care should be exercised. The system should be purged slowly to prevent drawing oil out of the system. Check compressor oil level after bleeding.

The air may also be bled from the system at the receiver. Crack the top connection flare nut slightly for a few moments. After you feel that the air has bled off into the atmosphere, close the connection and operate the engine and compressor. Observe the sight glass; observe the gauges; check the system to see if it is performing satisfactorily.

If it performs satisfactorily, you have bled off the air. If not, repeat until the operation is satisfactory.

PURGING EXCESSIVE REFRIGERANT FROM SYSTEM

Install the gauge set and operate to determine pressures.

Excessive amount of refrigerant will be indicated by high head pressure although the cooling effect is adequate. Place your hand on the receiver while the system is running. If the entire receiver is cold, the indication would be that the receiver is filled with liquid refrigerant.

"Open" the discharge service valve. Remove the gauge line connection. Turn the valve to the "Cracked" position to allow the refrigerant to bleed into the atmosphere. The Freon-12 will vaporize upon entering the atmosphere. Care should be exercised in allowing

the Freon to bleed off. Bleed slowly to prevent the oil in the system from foaming and being pulled out of the system.

After you feel you have bled off the amount of refrigerant necessary to bring it to the normal charge, open the valve.

Attach the gauge line and "Crack" the valve.

Operate the system again and observe the sight glass and gauges. If the system operates normally, you have bled off the excessive amount of refrigerant. If not, the process must be repeated. When bleeding off the excessive amount of refrigerant, a cloth placed over the gauge port opening will prevent the refrigerant or any oil from splattering on the car or persons.

LEAK TEST PROCEDURE

Outward leaks of Freon-12 are detected and located with the help of a device called a Halide Torch, Tool J-5419. It is much like a gasoline torch to which has been added an "Exploring Tube" through which air is drawn by injector action from points at which leakage is suspected. The torch is heated with denatured alcohol or Anhydrous Methyl Alcohol.

Near the place where air is drawn into the alcohol flame is a copper reaction ring heated red hot by the flame. If the slightest trace of Freon comes through the exploring tube, the normally blue alcohol flame changes to green, thus indicating that the free end of the exploring tube is being held near a point of leakage (Fig. 30).

Operation of Halide Leak Detector

To operate the Halide Leak Detector, remove the base cap and fill with Anhydrous Methyl Alcohol.

The leak detector should be filled where there is no possibility of refrigerant fumes getting into the torch. Use no filling utensils that have been used for handling refrigerant.

Replace the cap, set the detector on a fire-proof surface, and fill cup below burner with alcohol. Light alcohol and allow to burn until almost gone. This will heat the burner and generate pressure on the alcohol in the cylinder. Open the needle valve slightly and light the burner. Lighting usually is easier with the end of the exploring tube "pinched" closed.

When the copper reaction ring becomes hot, adjust the needle valve to produce a smaller flame. The smaller the flame, the more sensitive the burner is to leaks.

Action of the torch may be checked by holding the end of the exploring tube where there is known to be Freon gas and noting whether the flame turns green. A flame that is yellow or white indicates that the exploring tube is clogged.

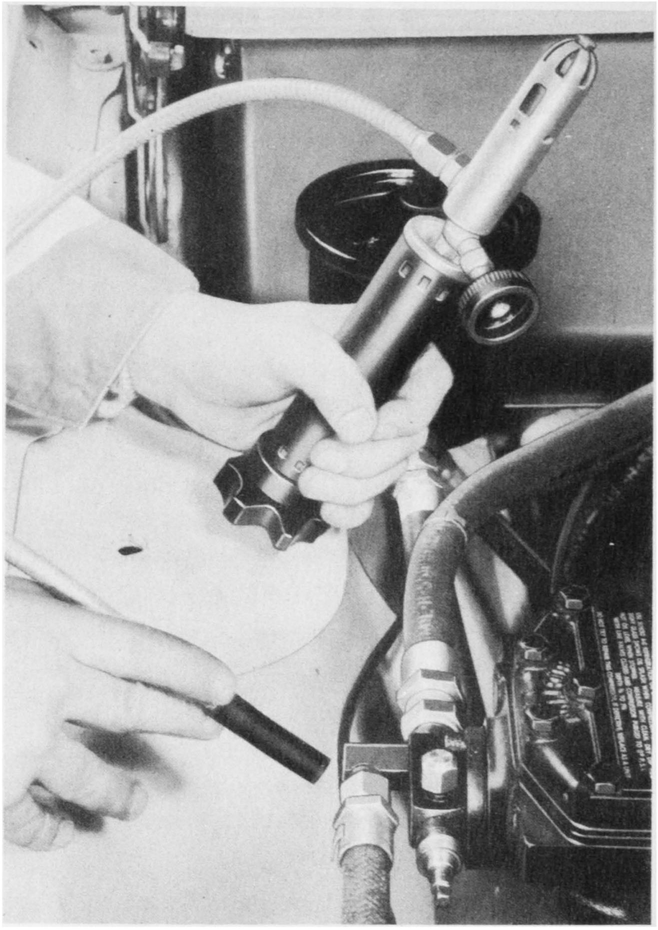


FIGURE 30
TESTING FOR FREON LEAKS WITH HALIDE LEAK DETECTOR, TOOL J-5419

Now, go over the apparatus being tested, holding the free end of the exploring tube close to every joint and passing it slowly *all around* the joint. It takes some time for any escaping refrigerant gas to be drawn through the exploring tube into the torch flame, so this part of the work must not be hurried. The worse the leak, the greater the concentration of refrigerant carried into the torch, the darker will be the green of the torch flame. Large leaks may turn the flame to a bright purple or may even extinguish it by keeping air and oxygen from the flame.

CAUTION: Avoid breathing the fumes and black smoke produced from the burner of the torch — they are poisonous.

NOTE: The control valve should never be closed tight when the burner is hot. Allow it to cool slowly, then tighten. If closed tight while burner is hot, the valve will freeze shut and damage the seat. Clean the orifice occasionally with the cleaner provided with the tool.

With very large leaks, the surrounding air may be saturated with so much Freon that the torch flame remains green all the time. This could happen where there is poor ventilation.

Several commercial type leak detection solutions are available that may also be used.

If a leak is detected by either method, do not run the system as the entire charge may be lost. Dirt and moisture may be drawn into the system.

If the system has lost its charge, it must be completely leak tested, leaks repaired, recharged, and checked again to make sure that there are no other leaks in the system.

If a leak is detected at a flare connection, retighten with suitable wrenches. Care must be exercised in tightening flared connection; copper is soft and the flare can be damaged.

If, after tightening, the leak is still apparent, the system must be discharged, the damaged connection or line replaced, and system recharged.

New gaskets may be required, packings in service valves, or whatever other corrective measures are required for the part at fault.

Threaded joints may be made tight by applying a paste made from litharge and glycerine mixed to the consistency of library paste to male threads. This paste sets hard in a short time.

Leaky solder connections may be soldered. A good grade of silver solder with silver solder flux is recommended.

CAUTION: Never solder a joint with gas in the system. This is extremely dangerous and should never be attempted. Release charge and recharge after connection is repaired.

COMPRESSOR

As outlined previously, servicing of the compressor is limited. The unit is returned in its entirety. Disassembly of the compressor is not recommended.

Compressor Valves

The suction and discharge valves are of the inertia type with both suction and discharge ports in the one valve plate. The valve reeds are highly polished Swedish steel. All valves flex to open and lift is limited.

Compressor Seal

The compressor seal is to prevent leakage or seepage of oil and refrigerant where the shaft extends out of the compressor when the compressor is stopped or running at any speed. The seal surfaces are flat vertical bearing with a lapped cast iron seal face sealed to the shaft with a neoprene "O" ring and revolving with it driven by a steel snap ring. The seal is a flexible neoprene bellows providing flexibility with a Teeplelite seal nose. A spring keeps the two flat surfaces together with accurate pressure under all conditions of operation.

Crankcase Oil Check Valve

There is a small self-operating check valve between the passage where the refrigerant gas enters the compressor and the crankcase. Some oil circulates through the entire system when the compressor is running. Oil returning with the suction gas from the evaporator opens the check valve and flows directly into the crankcase and the refrigerant gas flows upward to reduce the amount of oil pumped out of the compressor after a prolonged idle period. Oil and F-12 are miscible each in the other and during such periods, the oil in the crankcase absorbs some refrigerant. When the compressor is started under such conditions, the check valve is closed to a small orifice by the crankcase pressure so that the pressure reduces slowly minimizing foaming of the oil and the consequent oil pumping.

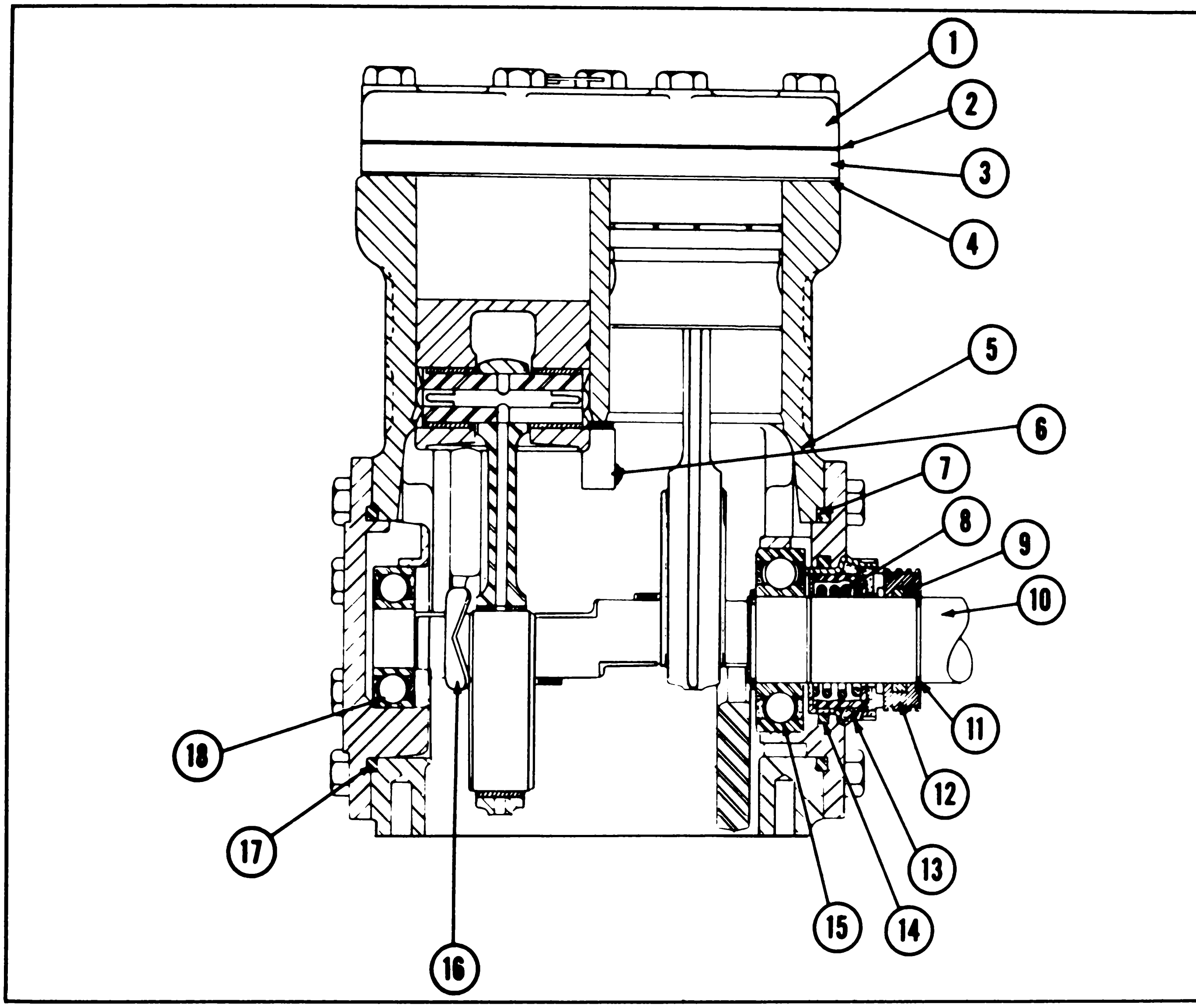
Compressor Lubrication

Lubrication of the compressor is by a combination of splash and centrifugal pressure. When the compressor is running, the cams and connecting rods dip in the oil lubricating those bearings and the main bearings which are ball type. Attached to the shaft is a stamped metal oil slinger which picks up the oil and fills a cavity above the rear main bearing. From this cavity, the oil flows by gravity to an enclosure at the rear end of the crankshaft. There is a rifle drilled hole through the crankshaft starting at the center of the rear end of the shaft and running diagonally to an opening at the seal. With the shaft revolving, a centrifugal force is created which puts the oil in the shaft under pressure. There are small exit oil holes to each connecting rod through the cam supplementing the splash oiling. The oil holes line up with matching rifle drilled holes the length of the connecting rods which carry oil under pressure to the wrist pins and through them to the oil grooves in the pistons which lubricate the cylinder walls.

Service Diagnosis of Compressor

An inefficient compressor is one in which either or both the suction valve or discharge valves leak. Both suction and discharge valves must seat properly to insure efficient operation to have a compressor that is functioning up to its capacity. The symptoms of inefficiency vary with the extent of trouble.

A compressor should be warm when testing as a cold compressor is not operating at its greatest efficiency. Turn the compressor over by hand. A definite compres-



1. Cylinder Head
2. Cylinder Head Gasket
3. Valve Plate Assembly
4. Valve Plate Gasket
5. Crankcase
6. Oil Check Valve
7. Front Bearing Housing "O" Ring
8. Seal Spring
9. Seal Ring "O" Ring
10. Crankshaft
11. Snap Ring
12. Seal Ring
13. Seal
14. Seal "O" Ring
15. Front Crankshaft Bearing
16. Oil Slinger
17. Rear Bearing Housing "O" Ring
18. Rear Crankshaft Bearing Housing

FIGURE 31
COMPRESSOR

sion should be noted. However, upon turning over the top of the compression stroke, there should be no tendency of the flywheel to follow around. If it does follow around, a discharge valve leak is indicated. As a further test, with no refrigerant in the system, attach compound gauge to gauge port and close the compressor suction service valve. Run the compressor for intermittent intervals of a few seconds duration and allow to rest for a minute or so in between. This will allow the Freon to separate from the oil in the crankcase. This also will reduce the crankcase pressure. After this has been done, run a vacuum check. If this procedure is not followed, false reading may indicate valve weakness and crankcase oil may be pulled out. The rapidity with which the compressor can pump a vacuum determines its efficiency. In general, a good compressor will pump down to a 26″ or 28″ vacuum.

A further test is to start the system with a pressure gauge in place on the discharge service valve. Close the valve; pump a pressure of 150 to 200 pounds into the gauge. This pressure will be pumped rapidly.

Shut off as soon as 200 pounds is reached. If the pressures hold, the discharge valve is good.

Inability of the compressor to build up to or hold normal pressures, while the system is operating, would also indicate inefficiency. This is, of course, if the charge is known to be correct and no air, moisture, or dirt is in the system. Replace compressor if it proves to be faulty.

Compressor Removal to Perform Engine Repairs

Clean dirt, oil, or any foreign matter from around the service valves.

Close both service valves; this isolates the compressor from the system and leaves the system sealed from the atmosphere. Loosen gauge port cap on discharge service valve and allow gas to escape from compressor slowly.

Remove service valve assemblies from compressor. The lines, both low and high pressure, are still attached to the service valves.

The service valves with the lines attached are shifted carefully to one side.

Loosen compressor belt adjusting lever screw and idler shaft adjusting link screw. (If equipped with power steering, the adjusting link is the same as for the idler shaft.)

Remove compressor belt from the compressor pulley and idler shaft or power steering pump pulley.

Remove the compressor from the compressor mounting bracket.

The compressor and idler shaft or power steering bracket can be removed from the engine.

Upon installation, new gaskets are necessary between the service valve assembly bodies and compressor.

After the compressor is reinstalled, operate system. Purge air from the compressor. Check oil level and the charge. Add charge if necessary although if the operation is performed properly, the amount of gas bled from the compressor is small.

NOTE: Be sure to close service valve openings on compressor while it is off the car. Plastic plugs or tape will serve to cover the openings.

Compressor Removal — Replacement Unit

The above procedure would apply in event the compressor is to be replaced by a new unit. Purge air from compressor. Check oil level and charge.

Compressor Removal — Servicing System

If it is required that the system be removed from the car or any parts are to be removed, the same procedure may be followed with the following exceptions. Instead of removing the service valves from the body of the compressor after the system has been discharged, the suction and discharge lines may be removed from the service valves, the lines plugged, and service valve line connections capped.

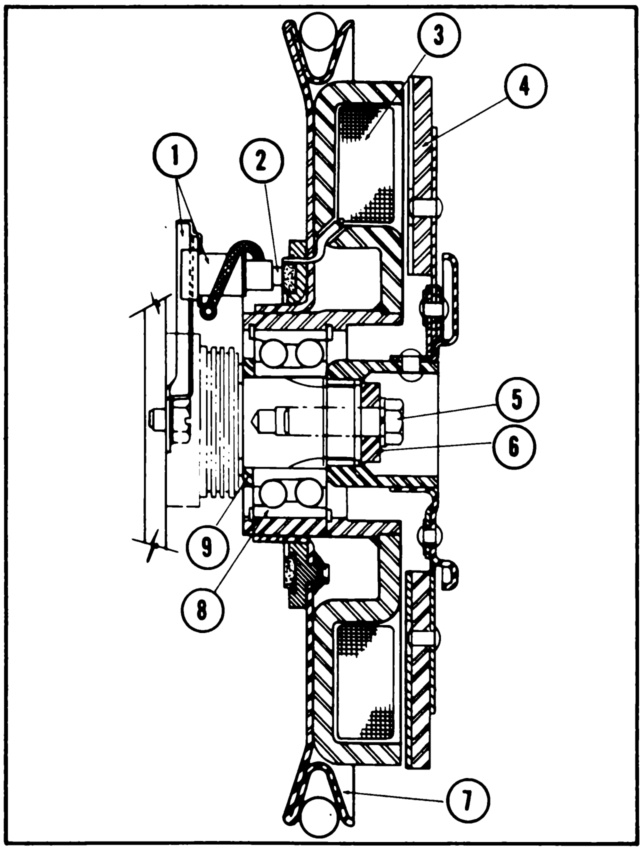
Upon reassembly, evacuate the system, charge, and operate unit to check operation.

MAGNETIC CLUTCH AND FLYWHEEL REMOVAL

Loosen the compressor adjusting lever screw and remove compressor belt.

The compressor must be tilted toward the engine to allow removal of the cap screw holding the magnetic clutch to the splined end of the crankshaft.

Remove the magnetic clutch (Fig. 32).



1. Bracket and Brush Holder
2. Contact Brush — Live Lead
3. Electro Magnet
4. Clutch Plate and Facing
5. Clutch Plate Retaining Screw
6. Washer
7. Compressor Pulley
8. Double Row Ball Bearing — Center Bearing
9. Spacer

FIGURE 32
MAGNETIC CLUTCH AND COMPRESSOR PULLEY

The pulley and center bearing are a tight fit on the crankshaft of the compressor. A spacer is provided behind the center bearing of the pulley to properly space the pulley on the compressor.

The brush holder bracket of the magnetic clutch is mounted on the compressor body.

CONDENSER REMOVAL AND REPLACEMENT

The condenser is mounted on the radiator air baffles ahead of the radiator.

Clean all connections of dirt and oil; then discharge the system.

Drain cooling system and remove the radiator from the car.

Disconnect the high pressure line from compressor to inlet connection of condenser at the top of the condenser. Use two wrenches of the proper size on these connections to prevent twisting the copper lines.

Remove the splash pan assembly.

Disconnect the outlet connection from condenser outlet to check valve manifold line.

Remove the condenser from its mounting on the radiator air baffles. For ease of removal, the condenser may be removed from below the car.

Upon replacement, install the gauge manifold set, evacuate, leak test, and charge the system. Run the engine at idle for ten to fifteen minutes to normalize the system. The high pressure should not exceed 275 pounds pressure. Should the pressure exceed 275 pounds, it would indicate air in the system. Purge the air from the system by cracking or slightly opening the high pressure gauge to the center connection of the gauge manifold set and bleed the air to the atmosphere. This, of course, is done with the system shut down and not operating.

RECEIVER REMOVAL AND REPLACEMENT

The receiver is mounted on the right hand side of the front engine crossmember.

Clean all connections of dirt and oil and discharge the system.

Disconnect the connection from the check valve manifold line to receiver inlet.

Disconnect the connection from the receiver outlet.

Remove the receiver from the front engine crossmember.

Upon replacement, install gauge manifold set, evacuate, leak test, and charge the system.

Start the engine; operate the engine at idle for ten to fifteen minutes to normalize the svstem.

Observe the gauges, the high pressure should not exceed 275 pounds pressure. Should it exceed this amount, purge the air from the system.

CHECK VALVE AND MANIFOLD LINE REMOVAL AND REPLACEMENT

Clean all connections of dirt and oil and discharge the system.

Disconnect the check valve manifold line connection from the receiver inlet.

Disconnect the connection at the condenser outlet.

Disconnect the connection at the solenoid by-pass line. The check valve and manifold is held in place by the above mentioned connections.

This unit will be serviced as an assembly. If the check valve proves to be faulty, replace the entire valve and manifold line. There will be no need to break the solder connections and replace the check valve only.

Install the valve with arrow on check valve in the direction of flow of refrigerant; install gauge manifold set, evacuate, leak test, and charge the system.

Start the engine; operate at idle speed for ten to fifteen minutes to normalize the system. Observe the gauge to check the pressures. If the unit operates satisfactorily and the pressures are normal, the system is ready for use. If not, correct as necessary.

SOLENOID BY-PASS VALVE REMOVAL AND REPLACEMENT

The solenoid by-pass valve is located on the right wheelhouse panel extension.

Clean the connections of any dirt and oil.

Disconnect wiring lead and flare nuts at the valve. Remove the valve from the panel.

Install new valve; make sure the arrow is in the direction of refrigerant flow.

Install connector to wire on valve. Check the valve by connecting jumper wire to battery and listen to see if valve clicks "On" and "Off".

Install gauge manifold set, evacuate, and leak test system. Install charge, start engine, and operate for ten to fifteen minutes to check operation and pressures.

FILTER AND SIGHT GLASS REMOVAL AND REPLACEMENT

The filter and sight glass are located on the right wheelhouse panel.

The filter provides protection against dirt in the system. A fine mesh screen catches dirt that might be circulating in the system. It may be necessary to

remove it to clean the screen.

The sight glass provides a quick and sure way of determining whether or not the refrigerant charge in the system is sufficient. A shortage of refrigerant will be indicated by the appearance of bubbles under the sight glass. A brass cap protects the glass.

Whenever replacement of sight glass or cleaning of the filter is necessary, proceed as follows:

Clean the connections of dirt and oil.

Discharge the system.

Disconnect the flare nut connections on the inlet side of the filter and on the outlet connections of the sight glass.

The filter is held in place on the wheelhouse panel by a metal clip. Remove the screws and remove the filter and sight glass.

After cleaning the filter or replacing the sight glass, install gauge manifold set, evacuate, and leak test the system. Install a new charge. Start engine and operate the system to observe operation and check pressures. Make whatever corrections are necessary.

EXPANSION VALVE REMOVAL AND REPLACEMENT

No attempt should be made to adjust the expansion valve. Should the valve show malfunction upon diagnosis, replace the valve.

Discharge the system.

Remove the drain pan from the evaporator retainer housing. Remove the front cover from the housing. The expansion valve is now accessible (Fig. 17).

Disconnect the high pressure inlet line connection from the expansion valve (Fig. 23).

Disconnect the equalizer and outlet connection.

Note and mark the position of the power element or thermo-bulb on the suction line. When installing the replacement expansion valve, the thermo-bulb of the replacement valve must be attached in exactly the same location on the suction line.

The expansion valve is provided with flats upon which a wrench can be placed to help break a connection. Always use two wrenches of the correct size whenever breaking or tightening a connection.

After installing the replacement expansion valve, install the gauge manifold set. Evacuate the system and leak test. Install new charge, start engine, and operate system for ten to fifteen minutes to normalize the system.

Observe the gauge, check the pressures, and the operation of the system.

REMOVAL OF THE EVAPORATOR (COOLING COIL)

The evaporator is located in a retainer housing located under the right hand side of the instrument panel. The retainer housing attaches to the heater opening in the dash panel. To remove, proceed as follows:

Discharge the system.

Remove the drain pan from the bottom of the evaporator retainer housing.

Remove the front cover from the retainer housing.

Disconnect the high pressure inlet line from the expansion valve. Plug the line and cap the expansion valve opening at this point. Slip the inlet line out of the retainer housing.

Disconnect the suction line from the outlet line of the evaporator. Plug both lines.

Remove the glove box and the glove box mounting panel.

Disconnect the wire leads to the blower motor and the temperature control thermostat.

Remove the screws attaching the heater duct to the evaporator retainer housing and air return duct.

Disconnect the Boden wire from the control lever of the defroster, air conditioning, and heater damper.

Remove the duct for the left hand blower from its opening on the evaporator retainer housing.

Remove the heater duct which is attached at the return air duct of the evaporator retainer housing.

Remove the screws (4) that hold the evaporator retainer housing to the heater opening in the dash panel.

Remove the bolts from each instrument panel to retainer housing bracket. These brackets are located at each end of the evaporator retainer housing (Fig. 17).

The evaporator retainer housing, the return air duct, which is an integral part of the evaporator retainer housing, and the blower motor housing, which is mounted on the top of the evaporator retainer housing, can now be removed as a unit.

The evaporator can be removed from the housing on the bench.

The expansion valve can be removed by following the expansion valve removal procedure.

The blower motor housing indexes with the air discharge grille openings in the instrument panel. The rubber seal on the top seals against the outer edge of the opening. When the evaporator retainer housing and blower housing are returned to their position, the seal will index with the opening.

Any of the other components of the evaporator re-

tainer housing such as: the temperature control thermostat, blower motor housing, blower motor, fan, and mounting brackets, and defroster damper may be removed at this time.

After replacement of the evaporator and housing, connect the wire leads to the blower motor and temperature control thermostat and install the parts removed.

Install the gauge manifold set, evacuate, and leak test the system. Charge the system. Start the engine and operate the engine for ten to fifteen minutes to normalize the system.

Observe the gauges and check the pressures.

Make the necessary correction if the system does not operate satisfactorily.

TEMPERATURE CONTROL THERMOSTAT

The temperature control thermostat is located on top of the evaporator retainer housing; the capillary sensing tube is inserted through an opening in the top of the housing, down into the coldest portion of the evaporator.

Approximately 5″ of the sensing tube must be in between the fins of the evaporator.

To remove the control thermostat, the glove box and glove box mounting panel must be removed.

REMOVAL OF BLOWER MOTORS AND FANS

Should it become necessary to remove the right blower at any time, follow the procedure outlined in Removal of the Evaporator. It is mounted on the top of the evaporator retainer housing.

To remove the left hand blower motor and fan housing mounted on the steering column support bracket, remove the instrument panel screw located at the lower left hand corner.

Remove the steering column support bracket screws to allow the steering column jacket tube to drop from its mounting to the dash panel.

Remove the instrument panel support bracket screws.

Disconnect the wire leads to the blower motor and remove the blower motor to steering column support screws.

The blower motor and fan housing can be removed by pulling the lower left hand side of the instrument panel outward to provide clearance to remove the blower motor and fan housing.

The left hand blower motor housing opening has a seal that indexes with the air discharge grille opening.

SERVICE DIAGNOSIS

To obtain full capacity performance of the air conditioning system, it is necessary that all components function properly.

Diagnosis of some of the components that may show malfunction are somewhat difficult to detect. The following describes the sequence and methods that might be used to determine whether the unit or part is functioning properly. Also outlined are some of the symptoms that will indicate malfunction of the system. Use the gauge set in diagnosis of the system.

Expansion Valve

Charge lost from thermo-bulb — Should this occur, the valve will close tight and with the compressor operating, the suction pressure will pull down to a vacuum. Remove the thermo-bulb from the suction line and hold in hand; if no change in suction pressure is noted, the charge is lost.

Faulty super-heat setting — Cooling is adequate but frost-line moves past thermo-bulb. This could cause considerable damage due to the possibility of liquid reaching the compressor.

Moisture in system would be detected at the expansion valve by frost and suction pressure raising and dropping. When checking for moisture, energize solenoid by-pass valve so system will not by-pass.

Compressor

See Service Diagnosis of Compressor Section for checking the compressor.

Condenser

A condenser plugged with leaves, bugs, and dirt will not reject heat resulting in high head pressures. The owner must be informed to keep it clean.

Filter

A clogged filter will result in low suction pressure. The temperature of the refrigerant leaving the filter will be cooler than that entering. Expansion valve will hiss depending upon the degree of plugging.

Solenoid By-pass Valve

A faulty by-pass valve will not close or hold closed under pressure. This will be noted by lack of cooling. The refrigerant is being by-passed.

Temperature Control Thermostat

A faulty thermostat will not cycle the system. Install the gauge manifold set, place a thermometer at the

discharge air outlet, and operate the system. Note the temperature. If the temperature drops well below 32°F. and remains there constantly, the thermostat is not cycling the system. At the same time, observe the gauges; if the system indicates cycling, the setting of the thermostat evidently is too low.

Upon cycling, the suction pressure rises and the discharge pressure drops. It is possible that they will partially equalize.

SERVICE DIAGNOSIS

DEFECT	CAUSE	CORRECTION
Low Suction Pressure	Low Charge	Add Charge
	Filter Plugged	Clean or Replace
	Liquid Line Plugged	Replace
	Expansion Valve Super-Heat Setting too High	Replace Valve
	Expansion Valve Thermo-bulb Charge Lost	Replace Valve
	Expansion Valve Port Plugged with Dirt or Moisture	Clean, Eliminate Moisture, or Replace Valve
	Blower Fan Inoperative	Check Motors and Wiring
	Temperature Control Thermostat Does Not Cut-out	Replace Thermostat
	Moisture or Freeze-up	Open, Evacuate, and Recharge
	Expansion Valve	Replace
High Suction Pressure	Leaky or Broken Compressor Valves	Replace Compressor
	Low Charge	Add Charge
	Clutch Slipping	Check Clutch and Wiring
	Loose Belts	Tighten
	Expansion Valve	Replace
Low Head Pressure	Low Charge	Add Charge
	Leaky or Broken Compressor Valves	Replace Compressor
High Head Pressure	Condenser Air Passages Clogged	Clean
	Air in System	Purge
	Radiator Fan Belt Slipping	Replace or Tighten Fan Belt
	Excessive Charge	Bleed Excess
	Engine Over Heating	Check Cooling System
	Restriction in Discharge Line	Replace Line
	Restrictions on Outlet Lines of Condenser	Clean or Replace Condenser
	Restriction in Check Valve	Clean or Replace
	Restriction in Receiver	Clean or Replace
	Expansion Valve Super-Heat Setting too Low	Replace Valve
Compressor Noisy With Low Suction Pressure	Too Much Oil	Check Compressor Oil Level

TECHNICAL SERVICE LETTER REFERENCE

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